



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

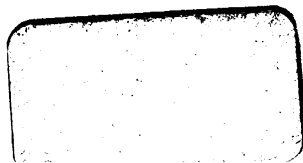
We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

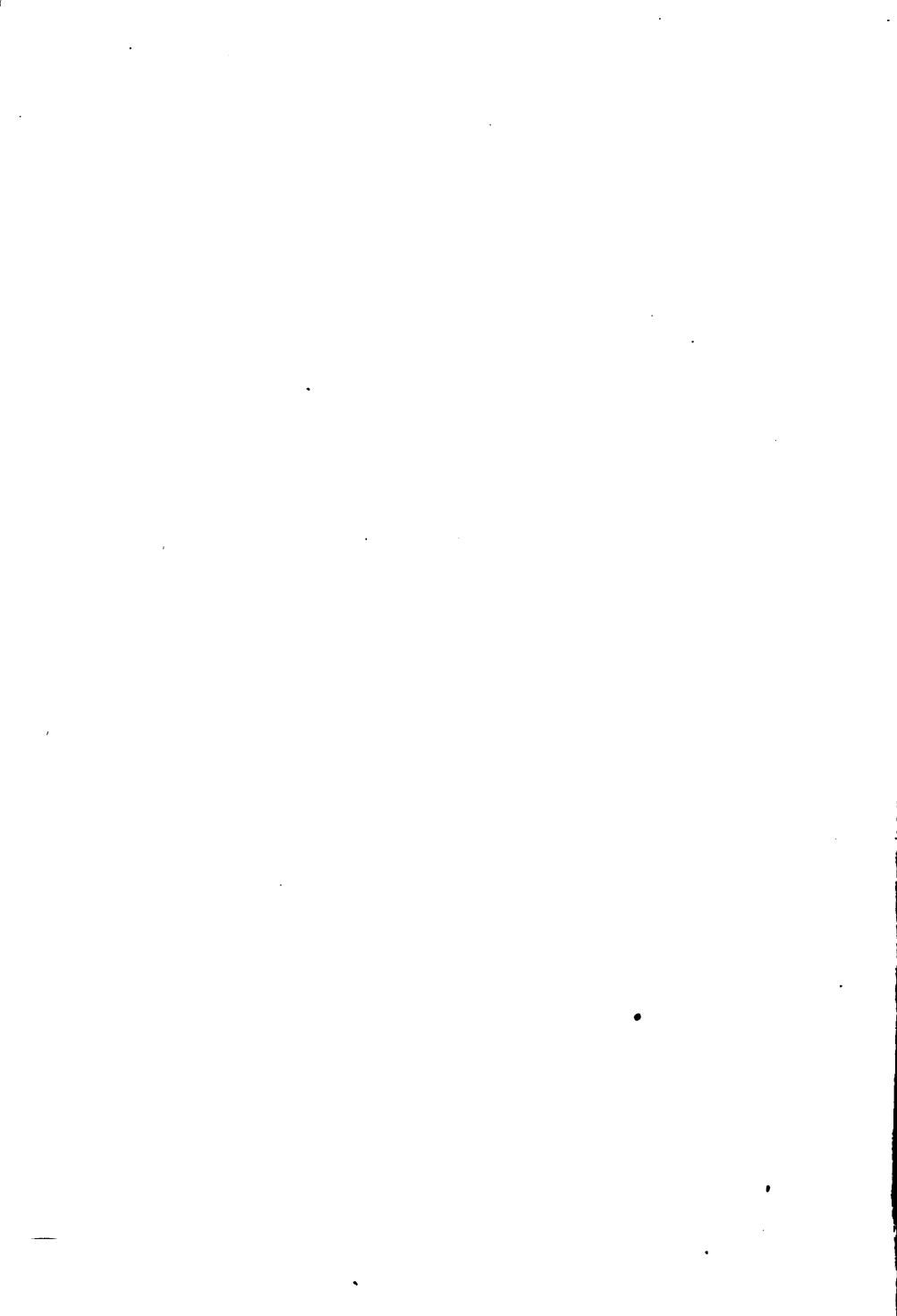
About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

Name



McGee, H.
McGee
AN



LIFE OF W J McGEE



DR. W J MCGEE

LIFE OF W J McGEE

DISTINGUISHED GEOLOGIST, ETHNOLOGIST,
ANTHROPOLOGIST, HYDROLOGIST, ETC., IN
SERVICE OF UNITED STATES GOVERNMENT

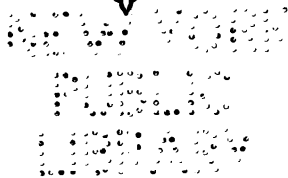
WITH

EXTRACTS FROM ADDRESSES AND WRITINGS

+✓

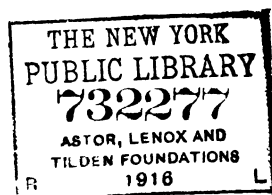
BY HIS SISTER

EMMA R. McGEE



PRIVATELY PRINTED
FARLEY, IOWA
NINETEEN FIFTEEN

Σ. 15.



COPYRIGHT 1915 BY
EMMA R. MCGEE

ROY WEN
DUB
VASSU

THE TORCH PRESS
CEDAR RAPIDS
IOWA

PREFACE

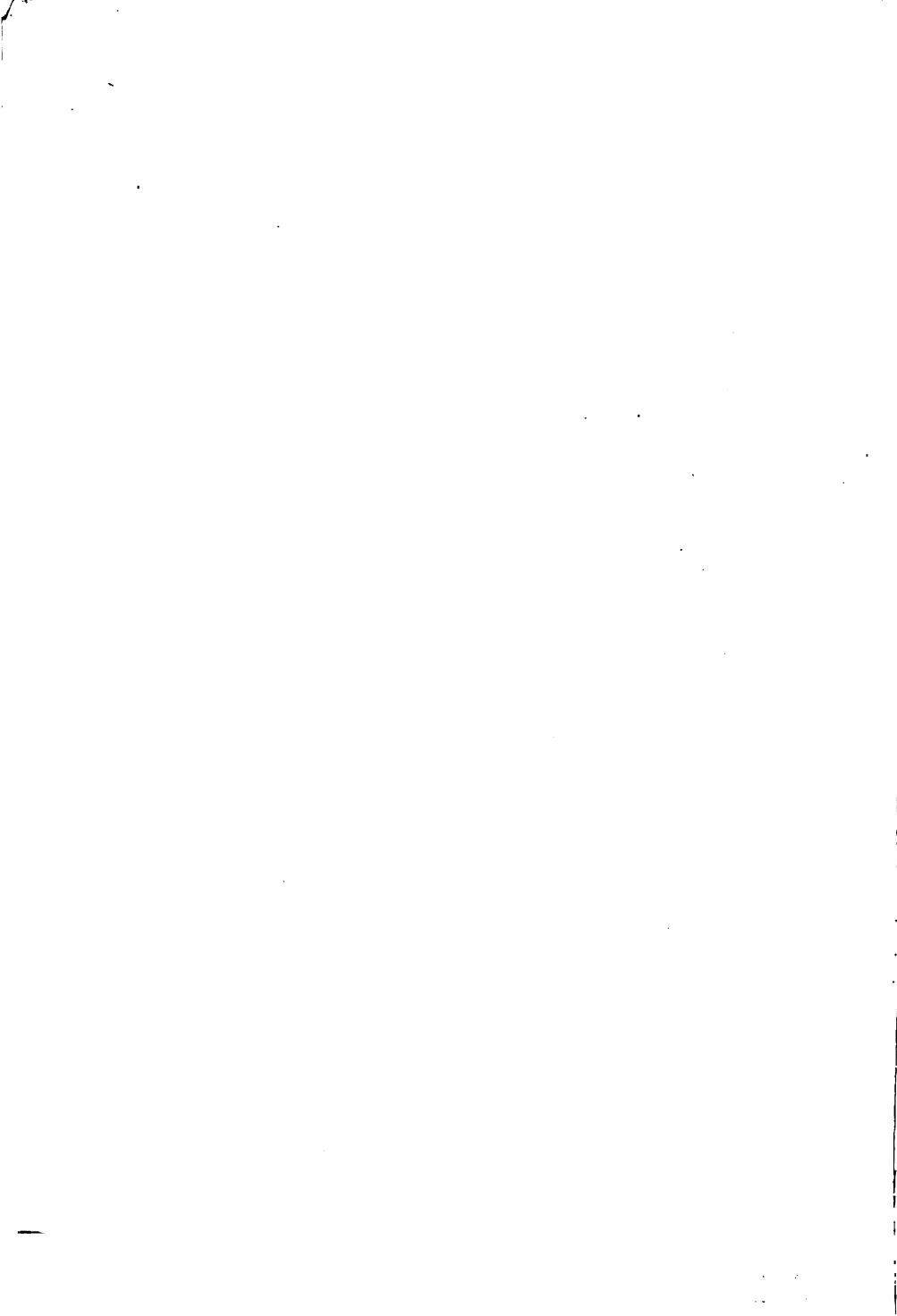
This book makes no claim to literary merit. In it perhaps may be found the sentimental, the bombast, the flowery, the too strongly marked personality, or other defects; but it was meant for a simple, unpretentious account of the life of a dearly beloved brother, published by his only sister as a tribute of her undying affection for him, with the feeling that the printed record of a life so prominent in scientific circles and so distinguished in the services of the United States government, with some extracts from writings, addresses, and reports, which are only samples of the splendid and indefatigable work he did, might be of interest to his many relatives, friends, and others who knew him personally or through the good he did or tried to do for the cause of science and humanity; nor was there any hope or desire of obtaining pecuniary or other advantages from the publication of the work. Nothing in the book can add anything more to the name or fame of W J McGee; but if these reminiscences will brighten ever so little the luster of that name and deepen the memory of the man in the minds of those who read its pages, the author can not feel otherwise, than happy and well-paid for her pleasant labor of love.

EMMA R. MCGEE

WOMEN
CLUB
YEAR

CONTENTS

CHAPTER	I	BIRTHPLACE	9
CHAPTER	II	PARENTAGE	15
CHAPTER	III	MORE REMOTE ANCESTRY	27
CHAPTER	IV	INCIDENTS IN LIFE	37
CHAPTER	V	EDUCATION	51
CHAPTER	VI	MARRIAGE	61
CHAPTER	VII	W J's LIFE WORK	67
CHAPTER	VIII	DEATH	73
CHAPTER	IX	EXTRACTS FROM WRITINGS	83
		IN THE DESERT	83
		THE CONSERVATION OF NATURAL RESOURCES	88
		THE SERI INDIANS	105
		THE WORLD'S SUPPLY OF FUEL	167
		DESERT THIRST AS A DISEASE	178
		THE CULT OF CONSERVATION	186
		THE FIVE-FOLD FUNCTIONS OF GOV- ERNMENT	194
		FLOOD PLAINS OF RIVERS	211
		SYMPTOMATIC DEVELOPMENT OF CANCER	228
BIBLIOGRAPHY			233



CHAPTER I

BIRTHPLACE

In a quaint, old farmhouse in the lovely state of Iowa, near the city of Dubuque, in the county of the same name, there is a small library containing many old volumes some of which almost a hundred years ago came from a far-off land beyond the sea. Among these is the Good Book, sacred, not only on account of its being the inspired Word of God, but also on account of its containing the family record of births and deaths, the forms and faces of the departed seen only in dreamland.

The fourth birth-date of the nine children born to James and Martha Ann Anderson McGee is this one: William John McGee, born April 17, 1853, near Farley, Iowa.

"The hills are dearest that our childish feet have climbed the oftenest and the flowers most sweet," and the memories, too, of these scenes are the longest retained. These hills and dales, so richly adorned and beautiful, cannot fail to impress and to inspire one who is in sympathy with nature. I am convinced that our home environs had no little influence in shaping my brother's career, by developing in him the desire to probe into the mysteries of nature and to bring to light and to record her secrets. I am convinced, too, that they placed him more intimately in harmony with her workings and deepened in him an inherent taste for the beautiful.

When a building spot was sought on the land my father entered from the government, my mother selected a site

with such a beautiful landscape view, that it might have driven to ecstasies either poet or artist. Several rods in front of the house was a semicircle of woodland. It was not in the "dim old forest," that enraptured the poetically inclined Cory sisters, but just the right distance to lend enchantment to the view. Here stately monarchs of the forest reared their graceful branches heavenward, interspersed with undergrowth of smaller varieties of trees and hazel-brush. In many places the semicircle of large trees was edged with wild plum and wild crab-apple trees and to the south was a pond and an open space. Over this pond and the edge of the timber land as it appeared to us, a beautiful rainbow often appeared in rainy weather, and when the days were clear and bright, we could look out of the door of the house in early morning, and see the sun just peeping over the trees and rising in all his splendor and glory. Nature seldom makes mistakes. The Divine Artist is the best we have. In all this grand panorama of rainbow and sunshine, of forest and open space, making such a gorgeous landscape effect, no improvement could possibly be thought of. No human artist could come near doing justice to the scene. It was especially beautiful in springtime and in autumn when Jack Frost began to assert his sway and to leave his brilliant markings and harmonious blending of colors on the forest leaves. Beyond our woodland, hills and vales succeed each other, the hills gradually rising in height until on the banks of the great Mississippi River they break off in precipitous bluffs. To the westward, vast rolling prairies extended almost uninterruptedly to the muddy waters of the Missouri, crossed only by the noble rivers which flow across the state. One of the great delights of our Iowa rivers, rills, hills, vales, and woodlands, was the abundance of wild flowers found in and near them. I have traveled over Uncle Sam's territory east to the "Hub"

and west over the Rockies to the Pacific Coast; I have caught glimpses of some of the belongings of other nations, but never yet have I found anything which, to my mind, could compare with the beautiful Iowa, in the way particularly of lovely woodland and native flowers. I have viewed a most magnificent sunset from the deck of an ocean steamer on the coast of California; and as the vessel moved slowly out of the harbor and away out into the deep, blue sea, the soft light of evening fell upon the smooth, placid waters of Humboldt Bay and a long gleam of light from the sun as it was sinking below the horizon, showed the grandeur and sublimity of ocean, coast, and mountain. What words could picture the beauty of such a scene! I have looked with admiration upon the *Sequoia gigantea* and other trees which grow with it near the Pacific Coast. The giant forests of California and Oregon; the cascades, rapids, waterfalls, lofty mountains, deep gorges, the fauna and flora of the Rocky Mountains have filled me with wondering awe and dread; but all these sights and sounds, and even Niagara's thundering roar, have not impressed me in the same way, nor filled my soul with the consummate joy I felt, in viewing the sights and scenes of Iowa in the days of her pristine splendor. Hers was not the wild and rugged grandeur of the Rocky or Himalaya regions, which is apt to fill the mind with awe and dread, but the calm, peaceful, and delicate beauty that inspires trustfulness, reverence, and adoration. Here were gently sloping elevations of land, covered with nature's most beautiful green and decorated with innumerable wild flowers most varied in hue, most diverse in variety, and in fragrance most intoxicating. Between these elevations, cool and shady ravines wound along, through many of which flowed tiny streams of clear, cold, spring water which gushed forth from rocks imbedded in these little hills. To describe adequately these scenes of nature's

primitive, transcendent glories, would baffle the power of human tongue.

Iowa's poet, the Honorable Eugene Secor, has composed a little poem about the *Building of Iowa*, which I here transcribe for it is thoroughly in accord with the ideas I have of my beloved land.

THE BUILDING OF IOWA

“The plows of the Infinite One,
By giants Herculean drawn,
Made ready the soil for this garden,
Before thy fortunate dawn,
My Iowa — beautiful land.

“From far away frozen regions,
In layers of generous till,
The hoary ice-king spread deftly
The grist of his adequate mill,
For Iowa — beautiful land.

“The Gulf with full buckets came flying
To water this garden of God;
And lo! a confessed miracle —
An undefiled carpet of sod
For Iowa — beautiful land.

“The clear, fishful lakes were teeming,
And bordered with consummate art;
The deep-valley'd rivers ran seaward
Through arbors of green — all a part
Of Iowa — beautiful land

“Soft-verdured with nutritive grasses,
The blue-stem that sped the swift deer
O'er leagues of bright flowers, varicolor'd

Ere the plowshares of toil silvered here
In Iowa — beautiful land.

“But God wanted men for thy building —
Strong men who were fit pioneers
To plant here the seeds he had garner’d
And sifted through long trying years,
My Iowa — beautiful land.

“They came — the brave sons of the forest;
They came — the picked manhood of toil;
They came — the best samples of Europe;
They came to raise *men* on thy soil,
My Iowa — beautiful land.”

But they ruthlessly cut down the forests;
Unwittingly they trod on the flowers;
Without ever a thought of the future
They destroyed thy beautiful bowers,
Oh Iowa! beautiful land.

[This verse inserted by writer]

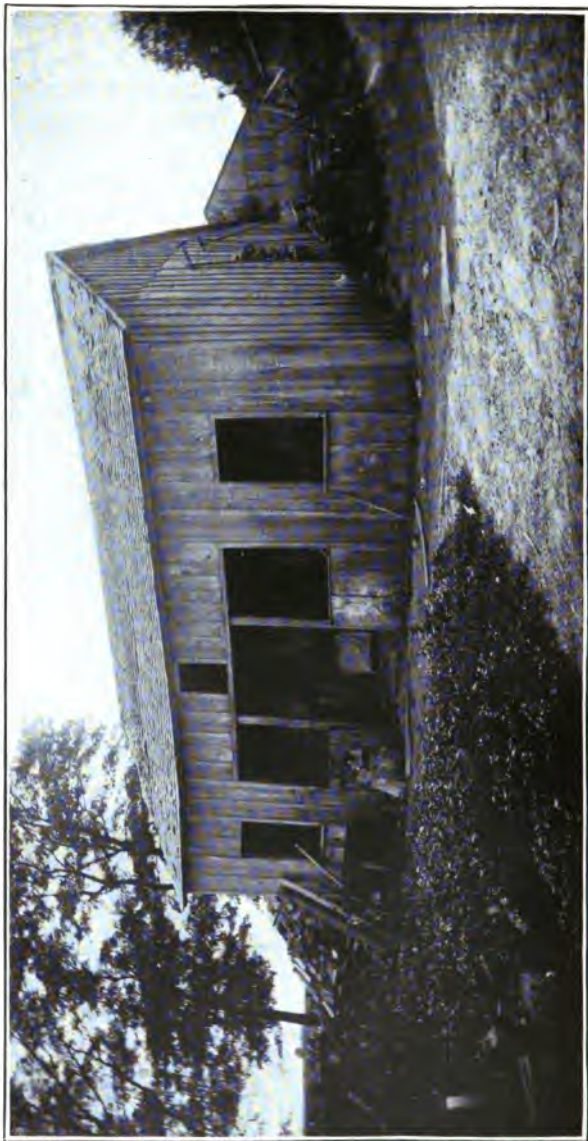
“They planted the school and the chapel,
They planted a liberal code,
They planted the altar and ingle,
They planted the epic and ode
In Iowa — beautiful land.

“Here flourish the seedlings of Progress,
Here Law and Religion are in bloom,
Here Art and Belles Lettres are budding,
Here grow the rich fruitings of Home,
In Iowa — beautiful land.

“The dear fragrant flowers of memory,
That comfort the spirit like wine,

The red rose of love and sweet friendship,
All to tether this glad heart of mine
To Iowa — beautiful land."

The house in which my brother was born was a very modest structure made of logs which were cut from the trees in our own woods. The lumber used for finishing the cabin, my father purchased from the Dubuque and Sioux City Railroad Company, the railroad now known as the Illinois Central, which was then in process of construction. They used little frame shanties to house the men employed on the road, and as there were no sawmills at that early date, to cut the trees into lumber, my father was glad to obtain one or two of these small buildings to aid in the construction of a humble home in which to rear his family. It lacked all the sumptuousness and most of the conveniences of the modern home; but round about it, on the outside, luxuries, that no modern home can buy, were spread in rich profusion far and wide. I have had this dwelling preserved as a memento of my childhood's earliest home, just as from my earliest years, I have tried to preserve the native plants and trees about the place from the ruthless touch of man and beast and other adverse elements; but in spite of my solicitous care and labor, some of the noblest trees have perished and some of the most delicate and rare flowering plants have been destroyed. Yet it pays to try to save the lives of these organisms, for in many respects they are truly living organisms as much so, in fact, as animals, and most of them respond to good treatment just like an animal and like the animal they resent all bad or indifferent treatment or neglect; being like grateful children, they bring rich filial returns and they compensate a thousandfold for all the care and toil they cost.



THE HOUSE IN WHICH W J MCGEE WAS BORN

CHAPTER II

PARENTAGE

The food one eats, the air he breathes, the clothes he wears, the darkness, dampness, dryness, the sanitary conditions and beauty of surroundings, are all so many factors, determining to some extent at least, whether or not his life shall be a success or failure; but these are not all. The changing moods and tempers of the members of the family circle are interwoven in the characters of each and every one, determining whether he shall be an unstable character under the sway of passion and impulse, or a self-regulated man or woman directed by an intelligent and reasoning will. It is, however, the mother more than anyone else, that largely settles what the child's after life shall be. If she is intellectual and her mind is active in the pursuit of useful knowledge, if she lives in an atmosphere of thought and conversation above the average gossip and scandal of every day social life, her children's minds will be more apt to be formed by the same high ideals; even one's far-distant ancestry may be all-powerful educators in exerting a molding influence upon their posterity. Man's inherited talents are in his blood and they will in all probability assert themselves and compel him to seek their development; but latent faculties will sleep unless aroused and stimulated by education or other means or influences brought to bear upon them.

W J McGee's parents were of sturdy Scotch-Irish parentage. Our father, James McGee, was born in County Armagh, Ireland, in 1808. He came to America in 1831. Like

many young men from the Old Country, he wended his way westward, coming to Iowa in 1832. He did not locate here permanently until the following year, but worked, in the meantime, in the lead mines of Galena, Illinois. When he came to Dubuque, there was a mining camp and only one house, which, it was said, Julien Dubuque had built. This was all there was at that time of the beautiful and populous city of Dubuque. In 1842, he entered a tract of land from the government which became his home and where he resided until he died on November 13, 1893, the year of the great World's Fair in Chicago. At the time of his death he was past eighty-five years of age. His death was deeply lamented by his many friends, who considered him a kind and benevolent man, and a good and agreeable neighbor. He used to give glowing accounts of events that took place during the Blackhawk War. He was present at the capture and death of the famous chief of the Sac and Fox Indians and he saw the sword that had been presented to Blackhawk by Andrew Jackson. This sword the Indian warrior constantly carried with him and when he died it was laid beside him in the grave. He was buried just across the Mississippi, in the Illinois country, on the farm of Captain A. Jordan. Later Blackhawk's body was stolen from the grave with the sword. The Jordan family recovered the sword and presented it to the Masonic Temple at Keosauqua, Iowa. This building was destroyed by fire in 1873 and the sword again disappeared. After a search of three years, it was found by D. C. Beaman, of Denver, Colorado, who ordered the noted relic to be given to the Iowa Historical Society, of the State University of Iowa. I remember Mrs. Jordan well. She was a friend and she lived to be over one hundred years old. She took a little Indian girl to raise and called her Kate. Some of Kate's descendants are now living in East Dubuque. Mrs.

Jordan believed her to be the equal in every way of the white race. Mrs. Jordan, however, was a woman, who as Longfellow wrote, believed "every human heart is human." Her sympathies were entirely with Blackhawk whom she considered a good man fighting bravely for the rights of his people. In her zeal for the poor red man of the west, she was not surpassed by Penn, Eliot, Williams, and others, who at a much earlier date labored so earnestly in educating and christianizing them and seeing that full justice was meted out to them.

My father was a member of the Methodist Church, very strict with himself in his attitude toward religion, but tolerant in this regard in his family. We all went regularly to church and Sunday school. During the last years of his life, he spent most of his Sundays in reading and studying the Bible. Nothing could drive his mind from this fascinating occupation, except the visit of his little grandson, Milo McGee, who, with his father living nearby, came frequently to our house on Sunday afternoons. When the child came into the house, the grandfather, who was extremely fond of children, particularly his grandchildren, was obliged to put away the Sacred Book and his spectacles and to spend the rest of the day in entertaining the young man, by dancing him upon his knees, carrying him out under the trees, or taking him to the barnyard to see the cows, pigs, chickens, and horses, or for a stroll through the woods, in summer time.

Our mother's name was Martha Ann Anderson. She was born near the great Mammoth Cave, in Kentucky. It was near where she lived, that many of the facts in *Uncle Tom's Cabin* which Harriet Beecher Stowe wrote, were obtained. Her uncle, William Chambers, was personally acquainted with the Selbys, noted characters in *Uncle Tom's Cabin*.

Mrs. Stowe, in the novel, had Uncle Tom killed by whipping but mother said he died in his own little cabin. My mother never knew any cruelties to be perpetrated upon the negro slaves in the place where she was born. It was just as Mrs. Stowe said in her book, that slavery in Kentucky was seen in its mildest form.

Our mother had better advantages than our father and was consequently much more studious, and better educated, and she certainly had a very discerning eye for all that is beautiful and sublime in nature. The poet has said, "There is a divinity that shapes our ends," and it has often occurred to me in fancy, that my mother's attitude toward nature in all its varying scenes and her oft told, vivid descriptions of garden spots where she had lived at different periods of her life may have had at least a trifle of influence in shaping my brother's career, by bringing his mind more frequently and directly into harmony and sympathy with nature, and instilling into it aspirations to add even a little bit to the world's sum total of human knowledge.

When my mother was a young girl, she came with her father first to Indiana and later to Sherrill's Mound, in Iowa. Sherrill's Mound was certainly at that time one of nature's own beauty spots. Here were the green, grassy mound, the sylvan spring, the trickling stream, with its mossy banks, the stately trees, and the soft clinging vine, and flowers everywhere bloomed in their wonderful loveliness as they must have bloomed in Eden, all which could fill one only with exulting gladness and awaken in one's spirit soft echoes of anthems which continually over God's Paradise roll.

The first time I saw Sherrill's Mound my brother W J and I were riding along by it, on a bright moonlight night. He pointed out the place to me and it surely was a vision of

unsurpassed loveliness. Every corner, every opening, seemed to be illuminated by the soft beams of the yellow moon. The greensward stretched away everywhere to the bases of strange, spectral forms of trees, outlined against a starry sky, while a tiny, silver thread of spring water went singing down a gentle slope from its rocky source — all making an almost perfect bower abounding in so much that nature can supply. This was one of eastern Iowa's most picturesque places.

Today scarcely a trace of this primitive beauty remains. As was indicated in Mr. Secor's poem above, man's destructive proclivities wrought its ruin. It is unfortunate that the material and immediate interests of the early settlers influenced them to such an extent, that they became totally oblivious to the fact, that trees are the grandest and most necessary product of nature, and that flowers form the finest drapery that adorns the earth in all lands, and that from a utilitarian and scientific viewpoint, their value cannot be estimated. Those men never seemed to realize that the preservation of the trees and flowers and especially the care of the trees, is one of the most important subjects that can engage the mind of man; for truly they are one of the greatest benefactors of the human race. If their universal destruction should take place, this fair earth would become a desert waste on which no life could live. While they at once yield a vast amount of products necessary to civilized man, if managed properly, they would yield a greater benefit, in the long run, to the individual owner, to the community, and to future generations.

With all due respect and honor to those early pioneers who braved the hardships of frontier life and suffered its privations, one cannot but regret, that they should have deemed it necessary to destroy so much beauty and grand-

eur and utility, and that they should have looked upon forests with no other design than that of getting the greatest amount of immediate benefit or profit from them. Even today many do not regard them of much use, except as sources of certain paying products, under the name of lumber, tan-bark, charcoal, woodpulp, resin, tar, turpentine, etc., giving no consideration to the effects they have upon climate, rainfall, droughts, floods, health, or the beauty or the attractiveness of a region. These early settlers here and elsewhere, cleared off in the cheapest way great forests of the finest trees, which if standing now, would be worth more, far more, than the ground upon which they stood can ever be worth for farming.

As all know, trees and flowers have been the admiration of the greatest and best men of all ages. The ancients fully understood the economic and hygienic value of trees. The cedar of Lebanon was justly the pride of the Jews and it appeared to them the emblem of strength and beauty. The palm was almost revered by the Hebrews. In tree planting, the Egyptian, the Greeks, and the Romans were most proficient. Hence Thebes, Memphis, Athens, Carthage, Rome and Pompeii and Herculaneum, as their ruins still show, had their shaded streets or parks. More than 2000 years ago, the richest Romans maintained rural homes as does the wealthy Londoner, Viennese, and Berliner today and their ancient villas were lavishly adorned with shrubs and flowers and trees. The Paradise of the Persians was filled with trees and roses. The taste for beautiful gardens was transplanted from Persia to Greece and the Greek philosophers held their schools in well-kept gardens or groves. The devastation of parks, the destruction of shade trees, the neglect of public gardens and private grounds, the decay of rural tastes and the utter slights of

home adornments were clearer proofs of the lapse into barbarism than the vandalism which destroyed the proud monuments of classic art and literature. The terrible European War today is destroying not only human life but beautiful churches and other works of art which date away back in the Middle Ages and whose mode of construction, in many cases, and the colorings, carvings, and decorations can never be reproduced, for the secret of their formation died with the men that made them. But even the effects of these destructions by war, great as they are and deplorable in the extreme, are not comparable to the deleterious effects of the destruction of forests upon future generations. But there are signs, not only in the state of Iowa but in every state in the Union, of the growth of popular interest in this subject as evidenced by the creation of the National Forestry Congress, the formation in many states of associations of horticulture and agriculture, Park and Forestry Commissions and other measures, calculated to awaken in the minds of the people at large, the vast importance of planting and preserving forests and adorning the waste places with shrubs and flowers, as well as the surroundings of their homes and schools and even extensive planting by the wayside. Mr. Peabody spoke truly when he said, "The debt of the present is to future generations. We owe it to those that follow us to leave our lands the better for our tillage and tree-planting and floriculture and we wrong ourselves and them if our fields and yards and highways are impoverished by our improvidence."

Our mother began teaching school at Sherrill's Mound and later in the vicinity of Dubuque. At this time, the people in eastern Iowa were having troubles with the Indians. Northward from Dubuque the plank road was built upon which they were obliged to pay toll. Mother called

this road "along the Coulie." This word comes from the French word *couler* meaning to drain. It was very low and wet at that time along this plank road. Couler Avenue, in Dubuque, got its name from this road and it is about in the same place. Some men, who afterwards became quite prominent citizens of Dubuque, went to school to my mother at this time. Mr. James Marble, a Frenchman still living in Dubuque, is, so far as known, the only surviving person who in those early days, was one of her scholars. I spent one whole day in February, 1915, at the home of Mr. Marble who is now an old man eighty-three years of age but who is remarkably well preserved both mentally and physically. His parents died when he was very young and his uncle, Antoine Lorr, also a Frenchman, took him to raise. The place Lore was named after Mr. Lorr although they changed the spelling from Lorr to Lore. Mr. Lorr employed my mother as governess to teach his nephew and a negro ward of his.

Mother related an incident to us which occurred at that time and created much excitement. Such incidents are apt to happen in new countries thinly settled and where law and order are not properly enforced. A man named Teagarten sold the Indians some whiskey and under the influence of the liquor they killed Teagarten. Mrs. Teagarten was from home at that time. There were two children in the house whom the Indians struck. They purposely fell to the floor and pretended to be dead. The children were not seriously hurt but they bore the scars made by the tomahawk till their dying days. As soon as the Indians left the house, the children went in search of their mother. The Indians were arrested and lodged in jail which was an insecure log cabin heated by a stove. While awaiting trial one of them killed the other with a stick of stove

wood and then made his escape. The weather was extremely cold and after a very short time, he came back to the jail and begged to be incarcerated again saying, "Me cold!"

Our parents were married August 7, 1844, and soon afterwards they came to live on the farm previously obtained by my father from the government. Nine children were born to them. The oldest died in infancy. The next was George Henry who remained at home until he was past twenty-one. He was very helpful to mother who often said she did not know how she could have managed with her work, were it not for him. He cheerfully rocked the other children to sleep, took every care of them, ran on errands, and assisted her in every way possible. He attended the common school at home, first, and then went to Cornell College at Mount Vernon, Iowa, and became a civil engineer. He took up his abode in Clearwater, Nebraska, where he died September 29, 1913. His life work was mainly surveying but he also served several years in the Nebraska legislature. His funeral was the largest ever held in the county where he lived and most beautiful floral tributes were sent by the General Assembly.

From the *Clearwater Record* I copy the following: "George Henry McGee was born September 30, 1848, near Farley, Dubuque County, Iowa. He was the eldest living son of the late James and Martha Ann McGee. His life was spent on the home farm, northeast of Farley, Iowa, until attaining his majority, except during the time he was in college. In 1871, he came to Nebraska, where he has continuously resided. On July 9, 1881, he was united in marriage to Miss Adelaide Van Ostrand. To this union were born nine children, Emma Louise, Stella Edna, (Mrs. Miller) Georgiana, Edward Clark, Susan Mildred, Minnie Martha, James Eugene, David Henry and Francis Marshal,

who with their mother, two brothers, David of Mission, Texas, and Isaac of Farley, and one sister, Miss Emma of Farley, survive him. Without pain or suffering, he crossed the great divide. The last words upon his lips were, 'Don't worry, I'm better now.'

"The death of George Henry McGee removes a good citizen, a father who ruled his family by love and kindness. To her who was his companion he never gave an unkind word, filling the great end and aim of human life, 'True pathos and sublime makes a happy fireside clime for weans and wife.' He leaves to his family a name untarnished by any disreputable or dishonorable act either in public or private life. Well may they take his life as their guiding star and inspiration. When he passed to that golden shore the record is, he lived to love and bless his fellowmen. On that beautiful, September morning answering the summons of the grim messenger he joined 'that innumerable caravan that moves to the mysterious realm where each shall take his chamber in the silent halls of death.' His favorite hymn sung at the funeral was:

"My days are gliding swiftly by,
And I, a pilgrim stranger,
Would not detain them as they fly,
Those hours of toil and danger.

"We'll gird our loins my brethren dear,
Our heavenly home discerning;
Our absent Lord has left us word,
Let every lamp be burning.

"Should coming days be cold and dark,
We need not cease our singing;
That perfect rest naught can molest,
Where golden harps are ringing.

“Let sorrow’s rudest tempest blow,
Each chord on earth to sever,
Our King says Come, and there’s our home
Forever, and forever.

“For O we stand on Jordan’s strand
Our friends are passing over,
And just before the shining shore
We may almost discover.”

David, the second oldest living son, was an expert in physics. His mechanical faculties were extraordinarily well developed. He, in conjunction with his brother W J and a cousin, invented and patented (June 9, 1874) an improved adjustable corn cultivator. They also manufactured them for a time, but the enterprise was not financially successful, nor was the invention a pioneer in its class. David is the old bachelor of the family and he is now in the vicinity of Lake Charles, Louisiana, looking after his extensive land interests of rice plantations and orange grove.

Isaac, the third remaining son, lived on a farm near the old home until a few years ago he moved to town to educate his two youngest children, William Isaac, familiarly called Nacy, and Mary Joy. Milo, one of Isaac’s older children, is not a prodigy of strength like the Greek Milo after whom he was named, but he certainly was a power in the land when he was a little boy, as I have already indicated, for managing his Grandfather McGee. He walked and talked before he was a year old. He and his sister Belle now occupy good positions as teachers in the public schools of Nebraska. George, Milo’s older brother, lost an eye in early life, which interfered with his obtaining an education, although he has a bright mind and is an

exceedingly good-hearted fellow. According to the opinion of an overloving, indulgent spinster aunt all of her sixteen nephews and nieces are bright, capable young people and they all give promise of being good, true, loyal citizens and noble men and women than which nothing is better.

Emma, the only girl of the McGee family, is the old maid and she still lives on the old home farm. The memory of so many things connected with this old home and her strong affection for the flowers, shrubs, trees, and birds remaining on the place, is so overmastering, that she feels she cannot tear herself away from them. In this respect she is something like the late Joaquin Miller, the poet of the Sierras, who for years lived alone on a high hill in the vicinity of Oakland, California. Here this poet philosopher has planted trees, as he himself expressed it, "I planted them 30,000 strong just fifteen years ago."

"Here I shall sit in sun-lit life's decline

Beneath my trees and somber verdant vine."

When this sage was asked by a visitor what caused him to go away up there to live a solitary life, with a merry twinkle in his eye he said, "To get away from fool-people." What wonder is it that one who has lived so long in this world should grow weary of the lack of harmony and the inconsistencies of humanity and that he should want to spend the evening of his life in some quiet spot there to enjoy that sweet repose which alone comes from close communion with nature!

CHAPTER III

MORE REMOTE ANCESTRY

Our great-grandfather, on the paternal side, was Alexander McGee of the County Down, Ireland, who came at an early date to this country. Our paternal grandfather, James McGee, died in the Old Country and his widow, whose maiden name was Rachel Ball, married Henry Hall, and in 1848, having lost her second husband in Ireland, came to this country and to Iowa. Her two children, Rachel and John Hall, father's half brother and sister, came with her. They made their home at father's for a while. When Rachel married she lived in Dubuque, and the mother made her home with the daughter in Dubuque. This grandmother of ours was a Methodist. At the time the church in Dubuque of that denomination was a very small log structure. Later a small frame building was erected. At both of these churches she attended divine service, but she was laid to rest in Linwood Cemetery before the Main Street Methodist Church was built on the spot where now the beautiful St. Luke's stands.

On the maternal side, the line leads back to Samuel Anderson, who was born at sea about 1740, of Irish emigrant parents. He resided near Yorktown, Virginia, and both he and Grandfather McGee participated in the Revolutionary War, on the American side, which fact, in a way perhaps, accounts for W J's intense patriotism. Grandmother Anderson's maiden name was Haggard, whose ancestry reached back many generations to a Welch family of Haggards residing in Wales. They are distinguished

particularly for their longevity. She was quite different from John Anderson, her husband, and our grandfather. She did not need to cultivate vim as people do now, for she had it in great abundance. She was rugged and masculine, while grandfather was more delicate, refined, and somewhat effeminate. He could not kill a chicken or any other animal for meat, but his wife, possessing no sentimentality, performed all such tasks as these without a single scruple, even setting broken limbs and bandaging severe wounds when called upon to do so. A first cousin of our mother's, named Nancy Haggard Smith, is living now (1915) at Concord, Minnesota. She celebrated her ninety-seventh birthday in April of this year receiving and answering several hundred congratulation postcards. She reads a great deal without spectacles and feels proud of the fact that she is related to H. Rider Haggard, the novelist of England.

Grandfather Anderson lived for a time in Kentucky where, as previously stated, our mother was born. Later he moved with his family to Indiana. His main life work was that of a country school teacher, beginning this work in the year 1800 and according to his diary he was still at it in 1840. The early settlers of these western territories prized education as much as they prized liberty, but they were often very poor and unable to pay the teacher with anything like the promptness such services demanded. This was the case in some of the districts where grandfather taught. He composed some lines in which he reveals his feelings on this subject which I here append:

My friends draw near and you shall hear
That which I'm going to say;
My school is out and there's no doubt,
I'm waiting for my pay.

As you have seen, I've faithful been,
 Attending every day;
 Both soon and late on you to wait,
 For which I want my pay.

With much concern, I tried to teach
 Your children well, I say!
 And can assert they learned expert
 For which I want my pay.

But some will plead "hard times" indeed,
 "Don't hurry me, I pray;"
 Though times are hard upon my word
 I truly want my pay.

I'm some in debt and cannot wait
 A very long delay;
 I'll be perplexed and sorely vexed,
 Unless I get my pay!

Lest I intrude, I will conclude
 And tell you by the way,
 That in the end I am your friend,
 And thank you for my pay.

Grandfather Anderson had truly a literary turn of mind. He wrote only one book. It is still in the family although it is a very old volume. It is a curiosity in itself, a veritable storehouse of information. One might almost say it touches upon every form and branch of human knowledge: education, medicine, law, agriculture, horticulture, angling, sea-faring, astronomy, machinery, slavery, banks and banking, politics, society, government, science, art, and religion. In it we find interesting articles written on beauty, friendship, ridicule, envy, curiosity, honor, forgiveness, quarrels, pity, love, marriage, patriotism, honesty,

courtship, happiness, conceit, and many other topics interesting and instructive. There are some very good ballads, addresses, hymns, essays, letters, and poems. The verses I am using in these reminiscences of course are not claimed by him as poetry. He calls it all doggerel. He merely jots down his impressions and feelings in these verses without much regard to rhyme, feet, measure, or poetry in true sense of the word. All the pieces in the book are interspersed with epigrams, riddles, fables, anecdotes, puzzles, acrostics, proverbs, enigmas, puns, epitaphs, obituaries, and parodies. In the medical department, we find some quaint but rational cures for Asiatic cholera, headache, toothache, cancer, colic, rheumatism, dropsy, white swelling, snakebites, and many others. Most of these, he says, are infallible cures. On the veterinary pages, he looks after the welfare of the horse in particular. In horticulture, to which he gave a great deal of his time, especially during the last years of his life, and in which he was always very much interested, we find methods of tilling the soil, the growing of cabbage, lettuce, melons, onions, turnips, beets, carrots, radishes, and particularly flowers. He was an enthusiastic lover of flowers. The hollyhock was his favorite as it was also the favorite flower of my mother. All his life he showed a passionate fondness for all the beautiful in nature but nothing appealed to him with so much delight as flowers. He communed with them as one is wont to commune with a dear friend. He cared for them as one cares for that which is best loved on earth. In common with his love for flowers he must have loved his vocation — teaching public school. A great part of his book is taken up with topics concerned with education. To the modern educator his views on school teaching may seem old-fashioned and queer; but they show the condition of learning

west of the Alleghanies, between the years 1800 to 1840, or even later, the period, at least, during which grandfather was in the business. Yet one cannot help feeling in reading his book, that he was abreast of his time in educational matters, that he was exceptionally energetic in his calling, and that he was keenly alive to the importance of bettering the schools in every way possible. In his "Some Sober Thoughts on Keeping School," his "Hints to Parents, Teachers, and Children," his "Address to the Patrons of Schools," and his "Reflections on Turning out Teachers on Holidays," we find he was confronted by some of the same questions which are agitating the minds of the school-men of the present time and our school-men of today are just about as near a satisfactory solution of these problems as were the teachers in the early part of the nineteenth century.

He must have been particularly interested in mathematics. He discusses the whole subject of Arithmetic and gives unique but simple illustrations of the solution of examples under almost every division of the subject. Book-keeping, too, is treated at length, and the elucidation of his methods in this art show originality, simplicity, and conciseness. Above all, in everything connected with his teaching he emphasizes neatness, simplicity, accuracy, and dispatch.

As a general thing, he seemed to be delighted with his work, and surely no teacher could be more interested in his scholars' welfare than he, yet there were times, when he, like all mortals in every calling in life, seemed to grow weary of his tasks and he was wont then to make a quiet complaint. This was especially noticeable during the last years of his life. On page 39 of his book he writes in 1838, "Only one day more of school and I am glad of it."

On page 242, on the 20th of June, 1840, we find written, "This day 40 years ago, I began to teach school on the same day of the week, the month, and the year. At this day my scholars learn just as fast as when I began. Though I am growing old I can teach all branches except writing. I can't write any more." Good writing at the present time is almost a lost art, but in grandfather's day more attention was given to it than to most other branches. Again, on page 238, he says, "Old age is coming on apace and with it all its infirmities. I am now in my fifty-ninth year. I will say in this place, my writing is so miserable I am ashamed of it. I have a rheumatic pain in my hand and forefinger and as a result my hand has become stiffened to such an extent that I have no longer good use of either fingers or hand." Some time later than this he complains of his hand being palsied, which was a fact and the disease remained with him until his death.

I copy in this place his "A picture of School-keeping," which shows something of the conditions he had to meet, the esteem in which he was held by people and scholars, his love for the work, and his preference for it above all other callings, and the irksomeness of his tasks when old age and infirmities were weighing heavily upon him.

"In the year one thousand eight hundred
It was on school-keeping I stumbled;
In the business I took great delight
In instructing the young to read and write —
I could write well and cipher too,
Excelled by none and equalled by few.
The scholars came from far and near.
All that came instructed were,
I had to manage all dispositions —
When out of school I had no rest;

They honored me, they me caressed,
Among teachers I was called the best.
It is true I succeeded well
In teaching youths to read and spell,
From the young man of twenty-three
To the tiny, bright-eyed A. B. C.
Yes, indeed, I would rather be
Among the lowly skilled to rule
My mansion — my little school —
Than in the pomp of splendid courts,
Or in the chase, the church, the town, or ball,
The school, I say, pleased me the best of all.
Thus from year to year from day to day
I happily passed my time away;
For at the end of every quarter
The money paid made time seem shorter;
On the last day of school every scholar
Generally paid up every dollar.
In old Kentucky good times I had;
But in Indiana things go bad;
The times are altered for the worse;
The Hoosiers take a different course;
For at the term's end I must say
I have to wait to get my pay.
Besides the school here is a place of pain,
Of trouble, care, and no great gain,
In doggerel rhyme I will this show
If you'll please read the lines below.

Ye Muses! ye little friendly tribe
Attend while I, a Hoosier school describe.
First in the morning as the scholars enter in
Each one comes with a confidential grin.
They take their seats, but with such scant graces

They soon grow restless and oft change places.
Then go giddy whispers round and round
Where monsters of dullness and blockheads abound —
Words nipping and clipping, offensive I hear;
A mumbling and buzzing often puzzling the ear;
I was often vexed and sorely perplexed by the din;
Some starting to speak, then falter their words to
begin;
Some itching and twitching and trying their fingers to
bend,
With pushing and crowding the bench at each end.
But as to their books one can see by their looks
If they can help it, to study they will not attend.
Some giggling and wriggling both this way and that;
Some spitting, others hitting, a full tit for tat;
And punching and pinching to pass away time
And make me lament the way I must earn my dime.
Wherever they be if the teacher doesn't see
They continue to plan to bother poor me.
With various tricks and capers,
And abusing books and papers,
The school is every day blended,
As if they surely intended
From the teacher all patience to rob.
Therefore the teacher must really be
A man of great PATIENCE you see;
This then is my second picture
From it I have formed the conjecture
That I'm dealing with wrong trained nature —
The uncultured man in miniature —
For busy fancy, reasons try to find
For the giddy freaks of youthful mind;
I have had a chance to know

For I have taught both high and low.
Now, I perceive I'm growing old,
My hand trembles the pen to hold;
I write the worse the more I try,
And cannot tell the reason why,
Unless old age coming on apace
Is leaving a nervous, broken space.
I used to teach with cheerfulness,
When energy unchecked by pain I had;
But now a school's a horrid place.
My rhymes are done, I'll quit the trade
I followed long, and nothing made.
To patrons, scholars, now I tell
A sad, a kind, a long farewell.

Among the things I have mentioned, Grandfather Anderson was also very much interested in every phenomena of nature, and made efforts to account for them by the light of his own observation, investigation, and reason. In the part of the book which has been destroyed there was an able article on the description of the earthquake of 1811. From this article my brother W J may have become convinced of the importance of seeing and observing the wonders of nature first hand; for at the time of the Charleston earthquake, he hastened away as fast as he could go, to the scene of the disturbance and he was on the spot with his seismometer, to take observations, before any other scientist had reached the place.

Along in the forties grandfather, now an old man, with his family moved to Sherrill's Mound, that beautiful spot of primitive flowers and exquisite trees which my pen has so feebly described in the earlier part of this work. One of his sons, my Uncle David, kept a diary. In it, while lauding the grandeur of their new home surroundings, he

describes the various feelings that swayed his mind on the road to Iowa, in leaving his childhood's home of joys and tears, jotting down the lines of the poet,

“As he loves his daily bread
The Hoosier loves his old homestead.”

On the summit of the mound this same boy, inspired by the solitary charms of the country, wrote a poem of real merit, about the death of his younger brother, Joseph, who that day two years previously, in 1844, died far away from his father's home in Indiana. This brother had come with a relative to Iowa before the rest of the family.

CHAPTER IV

INCIDENTS IN LIFE

In infancy W J was a very sickly, delicate child. My mother often said she was obliged to carry him in her arms almost constantly day and night, during the first years of his life. The attending physician told her, he had too large a brain for the strength of his body. He even remarked that he had a Daniel Webster head, which was not quite true for Daniel Webster had the larger brain. Who the physician was or what his professional ability was, I cannot say. It might have been in my brother's case as in that of many another, that mother love saved the child when the skill of the ablest physician only played a minor part. After he was about three years of age, his health and strength began to improve, although he still had a physical defect which fortunately later was entirely outgrown. Possibly he inherited from his ancestry a little of their ruggedness which enabled him to overcome these weaknesses of childhood. This inheritance was supplemented, too, no doubt, by conditions of a simple, abstemious life and vigorous muscular work. The influence and impressions of the world of nature, when one loves to explore her fields, are likewise most conducive to health and growth of mind, body, and soul; for it is generally agreed that exercise and healthy, symmetrical growth go hand in hand: sleep then is considered more refreshing, the mind is clearer, thoughts and ideas come quicker, the eye is brighter, taste is more perceptible, smell more acute, touch more

delicate, and the discrimination between right and wrong more true. The functions of all the bodily organs are bettered and a new elasticity and grace is imparted to the step and a new lease of life granted. As a result of these conditions W J when he reached manhood had a fine physical constitution, seemingly at least, and capable of enduring any amount of hard, physical labor, and showing not the least inclination to any diseased tendencies or weaknesses; yet notwithstanding his rugged, physical appearance he may not have been as well and strong as seemed apparent and his somewhat uncertain disposition helped to strengthen this fact.

Very early in life, he received the appellation "Don." By this name he was known and called throughout his life, by relatives, friends, and neighbors. He obtained the title from his younger brother, Isaac, who when a child could not articulate the *J* in *John* and thus made the word *Don*. He seemed to like this name himself for he taught his children to call him Don instead of papa or father. He has one living namesake in the family, his niece, the daughter of George Henry McGee, having called her oldest boy after him. His own oldest son, Donald, who died when very young, was named after his father, the *ald* being added to distinguish father and son. He always signed his name W J omitting the abbreviation marks after the initials.

He was very fond of good clothes and was quite tasty and sometimes he was quite fastidious in the selection of wearing apparel, always desiring that which was strictly according to the mode and the finest and best material.

In his habits he was most methodical and wanted things kept in their places. After he had been away from home for a number of years, in one of his visits to the parental

dwelling, he wanted a string to tie up a bundle. Looking about him he said, "When I was at home I could always find things just where I left them." As it happened, the twine for doing up packages was still kept in the same place and I told him he could find it in the cupboard exactly where he used to get it years before. One can scarcely turn round in the old home today, without seeing fossils, stones, bits of clay, and other things that he picked up on his excursions and brought home for the purpose of more minute study, and after he had examined and studied them sufficiently, they were laid away with care, yea, one might almost say with reverence.

It has been said by some that when he was at home he was lazy and inclined to shirk his share of the burdens of the family. Strictly speaking this cannot be true. In boyhood, youth, and early manhood, he worked hard on the farm, conscientiously doing as much as the other boys of the home. But a nature so intensely serious, so anxious for noble work, could not content itself with a work, noble too in itself and necessary, but which the great mass of humanity having no far-reaching, higher aims could do just as well. In this connection I quote from his Memoir written by F. H. Knowlton:

"Although it has been said of Mr. W J McGee that in his earlier life, he was averse to manual labor, in later life he certainly developed untiring energy as a glance at his many and varied accomplishments will show. He was also a good organizer and was systematic and painstaking in all he undertook. Even his last work on 'Wells and Subsoil Water,' the proof of which is before me, was recalled during the last weeks of his illness and was submitted but two weeks before his death complete to the last detail."

This energy he possessed all during his earlier years.

During the intervals of cessation from the arduous toil of the farm, he roamed over the country, observing the structure of mounds, the course of streams, making extensive investigations in caverns, examining rocks and soils, and studying fossils, etc. At night, when he could get the books to do so, he read up what others had said about all these things and in this way he laid the foundation for a more thorough understanding and a broader view of the work which later engaged so much of his attention.

He was very helpful, too, about the house. What he did was done well and what he made was made to last. Once when he was very busy writing up a scientific article for publication, while mother and I were doing a big churning, the lid broke. We requested him to leave his writing, at once, and make a new lid for us. He set aside his writing, made the cover which fitted perfectly, but it was nearly two inches thick. We laughed about it and asked him if he intended that lid should pass down to his grandchildren. His reply was he did not want to stop his work again to make churn lids. That was long years ago. We have the churn lid yet as good as new and he has grandchildren, too, to whom it might have been bequeathed, had he so desired. He could, in fact, turn his hand to anything from making a churn cover for us to use in the house, to planning the construction of a large barn on his father's farm. His inventive powers were far above the ordinary. He made many little, useful contrivances for the home and as stated before, he and his brother David invented a farm implement which served its day and then gave way to something better in machinery which the wonderful inventive spirit of the nineteenth century continually put forth. He started a blacksmith shop in Farley, Iowa, worked at the business for a time and was successful in it; but such work

was not his calling and he soon abandoned the trade to take up a vocation which was more to his taste and bent of mind.

Although raised in a Christian family W J McGee never joined any church. Our mother was a Baptist and the tenets of her faith forbidding infant baptism, that rite was not performed on him. He was not a scoffer at religion, however, as some might think from things he has said and from some acts in his life in reference to it. One cold, drizzling day in December he came into the house from his work exclaiming petulantly, "This is abominable weather." Our father gently reprimanding him quoted the lines of the hymn, "When I am happy in Jesus, December's as pleasant as May," to which Don replied, "The fellow that wrote that did not have to stay out in such weather as this or he would not have written it." Mr. Knowlton, referred to above, in speaking of him as a man of cordial, sympathetic manner and of deep human sympathy, tells of an incident that is related of him when he was in attendance at a meeting of the American Association. He was asked by a local divine to fill his pulpit at the Sunday evening service. Although not affiliated with any church, Don at once accepted the invitation and selecting for his text the words, "Love ye one another," it is said he delivered an address replete with human sympathy and understanding. He certainly had the Christian spirit for Mr. Knowlton says, "He was kind and considerate to those who worked with him and generous to a degree, it being rare—too rare indeed for his own best interest—that any appeal was made to him without substantial reward." I have in my possession a memorandum belonging to my brother, Don, containing an itemized account of his receipts and expenditures, when he was at home and was

just beginning to earn a little money that he could call his own. From what I have examined of this account book, I find there is scarcely a page on which a record is not made of money given for missionary funds, church supplies, festivals, picnics, and Christmas trees, for charity, Sunday schools, the purchase of Christian literature, and other religious purposes. The sums given ranged from twenty-five cents to five dollars which, considering the frequency of contributions and the amount of money he was receiving for his work, was by no means inconsiderable. He attended Sunday school regularly with the other children of the family when he was a boy and as to his knowledge of the Bible few men, leading a life as full as his, could know it better or could quote passages from it with greater facility and readiness. Like my oldest brother he had his favorite hymn selected in the years of his early manhood and which continued to be his favorite through all the years of his mortal life. This hymn, entitled, "Vain are all Terrestrial Pleasures," I copy in full for I feel that it shows the value my brother always placed upon things of earth as compared with the life he pictured beyond the tomb.

Vain are all terrestrial pleasures;
Mix'd with dross the purest gold;
Seek we then for heavenly treasures, —
Treasures never waxing old.
Let our best affections centre
On the things around the throne:
There no thief can ever enter;
Moth and rust are there unknown.

Earthly joys no longer please us;
Here would we renounce them all;

Seek our only rest in Jesus, —
Him our Lord and Master call.
Faith, our languid spirits cheering,
Points to brighter worlds above,
Bids us look for his appearing;
Bids us triumph in his love.

May our light be always burning,
And our loins be girded round,
Waiting for our Lord's returning, —
Longing for the welcome sound.
Thus the Christian life adorning
Never need we be afraid,
Should He come at night or morning,
Early dawn, or evening shade.

— *Ford*

In his school days, his loyalty to his friends was a prominent element in his character. Like most boys he thought it a noble act to screen his schoolmates from punishment without taking into consideration whether the lads were deserving of punishment or not. One day a boy was threatened by the teacher for some misdemeanor, but on the approach of irate master the boy ran out of the house and down the road as fast as he could go. Don, doubtless having the confidence of the master and being a large, muscular fellow, was dispatched after the culprit and ordered to bring him back. My brother was fleet as a deer and soon came within hearing distance of the poor fellow and then he told him to run with all his might so that he could not catch him, at the same time slackening his own speed, and the boy escaped.

That Don was somewhat eccentric cannot be denied. This trait in his character may have been due to lack of all

round culture of the schools or to physical causes. He had a somewhat nervous morbid organization which was kept up by excitement. His seeming awkwardness and oddity in early years were probably assumed to cover over his diffidence and extreme super-sensitiveness. It is an acknowledged fact, however, that a true man in a false world or a man who is simply nature's child must necessarily be eccentric. My mother had a habit when reading to chuckle aloud when she came to anything funny or ridiculous. One day while thus engaged I heard her laugh. I requested her to read the amusing part to me. It was concerning an editor named Johnny Lang and a poet of some distinction. The former becoming displeased at the versemaker about something, referred to him in his newspaper as "the fellow with a zigzag brain." The poet seeing this, penned the following lines:

"I will tell you Johnny Lang in the way of a laugh,
In answer to your rude and unmannerly scrawl,
That in my humble sense it is better by half,
To have brains that are zigzag than no brains at all."

My brother, however, became more masterful as he grew older and went out into the world and had greater opportunities of meeting people.

On some of his scientific trips he was often regarded with suspicion. Dressed suitably for the work in hand, when he started out he probably presented the appearance of well clad farmer or laborer at work; but after traveling for weeks, perhaps, through grain fields, brush, and thorny brambles, wading streams and struggling through mud and dust, he acquired the look of a common tramp, lunatic, or robber, and for such he had been taken more than once, by people through whose country he passed.

On the Atlantic Coastal plain he stopped at a hotel one evening to secure lodging for the night. He was dressed in the usual corduroy, doubtless somewhat the worse for wear and tear, and the clerk at the hotel positively refused to give him shelter, considering him a man not quite right in his head, even though he offered him more than the usual amount charged to lodgers.

On the Piedmont Belt he was arrested and was about to be searched for a robber. The officer and the man who had him arrested came at night to the inn where he stayed. He had retired and the landlord objected to having him disturbed. His remonstrance was so great, that W J's persecutors concluded to remain all night and to get him put into custody in the morning. When Don came down to breakfast after a night of refreshing sleep, the hotel proprietor introduced him to the officer of the county. The two men felt like throwing up their job and retreating at once, but Don brought forth the contents of his pockets, telling them in the most gentlemanly way that he was not a robber.

Clad in one of these garbs, he unexpectedly made us a visit at the old home. At the time I had a dog that took it upon himself to be my protector, accompanying me and acting as a body-guard, whenever I went roaming through the woods and fields in search for flowers, berries, or for pleasure. I saw Don coming down the road before the house and ran to meet him, the dog following. Grasping my brother's hand by way of greeting him, the dog rushed at him and it was with difficulty that I prevented the cur from tearing him to pieces. The animal would not even let me walk by my brother's side or near him, and while he remained with us the cur kept his eye upon him, refusing all overtures to make friends with him. He was wont to

act quite differently when Don came home dressed up like other people. But withal my brother was affectionate, sincere, brave and true and proud; yes, proud to a fault, his eccentricity being of little moment.

He never learned to smoke. One time he found himself in the company of a number of young fellows who had just learned to smoke cigars. They knew all there was worth knowing. Don said he would rather associate with those who did not know so much, for their silly, supercilious talk bored him and he was nauseated by the smoke of the cigars.

My brother told of a terrible experience he had when he was out in the desert of Arizona making meteorological observations and studying the effect of light upon life in the desert. Where he was encamped there was an abundance of water due to the light rains and the seepage from the precipice above which was several hundred feet in height. Except at this place there was no water to be found nearer than thirty-five miles to the northwest and eighty miles to the eastward, and the nearest town was thirty miles north in an air line over broad sandy wastes.

One morning two men on horseback came into the camp. They were Mexicans, one about sixty-five years old, the other forty. They were on their way to some "lost mines" farther on, which had been rediscovered by the younger man. This younger man had a fine and vigorous physique. He was almost six feet in height, broad-shouldered, deep chested, a well-built man in every way and capable of enduring any amount of hardship and fatigue. Don did not like the appearance of the older man from the first. He seemed like a man that would betray another without any compunction, and extreme selfishness and cunning were perceptible in his every act. They had a good supply of food with them — enough to last ten days or more. They

remained all night in the camp and in the morning, after filling their canteens with water, set out again for the mines. At midnight the old man returned to the camp with two horses. He reported that the younger man had gone on and had sent him back for water and that he would meet the younger man at a point in the trail known to both. The next day the old man set out again with an abundance of water but returned again in the evening saying he could not find his companion. Don sent out José, his servant and guide, to look for the lost man, but José, after wandering about for a day and a night, came back to the camp exhausted by fatigue. All hope of rescuing the man was now given up, for he had been out several days with only a small amount of water and few live longer than two days in the desert when deprived of water. The old Mexican went back whence he came and my brother still being concerned about the lost man took his guide and for two or three days they traveled many miles hoping to get some tidings of the unfortunate man, but they were finally obliged to give him up.

About eight days after the Mexicans had left the camp, early one morning, Don and his man were awakened by a terrible cry like that of an enraged animal. My brother suspected it was the lost Mexican. Hastily supplying themselves with water and medicine they set out in the direction whence the noise came.

On the sands under a tree they found the poor fellow in a terrible condition. In Don's note book a description was given of the appearance of the man. "There is no death more cruel than that of the 'desert thirst.' The man was entirely naked; his big, strong legs and arms were shrunk to the very bone; his ribs bulged out like those of a starving horse; his habitually plethoric abdomen was

drawn in almost against his vertebral column; his lips had disappeared as if amputated, leaving low edges of black tissue; his gums and teeth projected like those of a skinned animal and his flesh was dry and black; his nose was withered and shrunken to half its size and the nostrils and vomer showed black; his eyes were set in a winkless stare, his face was as black as a negro's and his skin was turned a ghastly purple with great livid blotches and streaks; his lower legs, feet, forearms, and hands were torn and notched by contact with thorns and sharp rocks, yet even the freshest cuts were as so many scratches in dry leather, without a trace of blood; his joints and bones stood out like those of a wasted consumptive, though the skin clung to them suggesting shrunken rawhide used in repairing a broken wheel. From inspection and handling I estimated his weight to be about one hundred and fifteen pounds.

"We soon found him deaf to all but loud sounds and so blind as to distinguish nothing save light and dark. The mucuous membrane lining his mouth and throat was shriveled, cracked, and blackened and his tongue was shriveled to a mere bunch of tegument very black. His respiration was slow, spasmodic, and accompanied by deep moaning or roaring—the sound that awakened us a quarter mile away. His extremities were cold, no pulsation could be detected at the wrists and there was apparently little or no circulation beyond the knees and elbows. His heartbeats were slow, irregular, fluttering, and almost ceased in the intervals between the breathings."

After three days of careful nursing my brother was rewarded by seeing the man return to consciousness and on the fourth day he took him on a wagon to the nearest station. He improved rapidly in health, strength, and flesh, but his hair, which was abundant and dark two weeks prev-

iously, was now an iron gray and the half of it at least was gone.

My brother took notes of what the man told him, when he could talk, about the ordeal through which he passed. "After the older man left him he reached the mines all right, posted notices there for a mineral claim, and then sought the road pointed out by his companion. He wandered over the sand for four days. His water gave out the first day. Then he was obliged to throw away his canteen, his clothing, and food. He suffered intensely from thirst and heat and fatigue. He finally became convinced that he had been misled and then rage seized him, to live long enough to kill his betrayer, was his most earnest desire. Don said, he thought this wrath taking possession of him was a powerful incentive, that it carried him on for miles and doubtless saved his life. On the fifth day he found the trail leading to the camp which was fifty miles away. On he went, sleeping in dry water courses, eating scorpion tails, wild gourds, and chewing insects. The sixth day his eyes grew dim, the mountains danced before him, the cactus moved back and forth. Now, too weak to walk, he tried to crawl and still he kept in his mind the mad desire to keep up his strength long enough to slay the man that so traitorously deceived him. On the seventh day he came to the place where he and the other Mexican had rested the last night they were together. He now felt sure of relief. He threw himself across the road so as not to be missed by anyone who might pass. The buzzards that had followed him for two days, now undaunted came near him eager to devour what remained of the poor creature. He plodded on and on and the eighth day he saw by the guide post that he was still seven miles from the camp. He was greatly disappointed for he thought he was nearer to the desired haven. He

could go no farther. He said his prayers and lay down to die. At daybreak the following morning he had a hallucination that he had died but that his soul remained in his body to ward off the buzzards. All the eighth day and night he crawled along when he could and on the ninth his voice tried to call for aid." This call was the bellowing that roused my brother and his guide. Don said, "The man was in the desert just eight days and nights with only one day's water. He rode in the saddle thirty-five miles and walked or crept between one hundred and one hundred and fifty miles. For nearly seven days or fully one hundred and sixty consecutive hours he was wholly without water from sources exterior to his body save the few drops extracted from scorpions, plants, and insects." "This is a desert record without parallel known to me," he said, "for half the victims of desert thirst die within thirty-six hours of deprivation; another quarter within seventy to eighty hours or hardly half of this man's record."

In the thousands of miles that Don walked in different parts of the country among people of all sorts and conditions in life, he had many tales to tell. In his expedition over the Alleghanies, he stopped one day at a house far away, as it seemed, from any other human habitation. He asked for something to eat. The good woman of the mountains hospitably gave him to eat out of her unsavory and meager store. She apologized for the quality of the food and said the last time she was up at the store, she bought something that the store man called "sugar." She wanted to keep this for guests, but having a family of five growing boys, "they got at it, and kept at it, and kept at it, until it was all gone."

CHAPTER V

EDUCATION

Mr. Knowlton in his memoir of W J, in reference to his educational advantages, says: "In these days of advanced specialization and refinement in the study of scientific problems, it has seemingly become, unceasingly evident, that the best measure of success can only be attained with the full panoply of modern educational equipment. Yet there have been in the past and there will be in the future, doubtless, notable exceptions to this rule. It has often been said of one who has reached an eminence without the stimulating aid of early educational advantages, that had he fortunately possessed this training, no one may measure the higher eminences to which he might have ascended. Rather is it possible, indeed probable, that the spark of genius is stimulated by adversity and that breadth of vision and strength of character come oftener as the fruit of action rather than of ease; for

" 'So doth luxury make weaklings of us all.' Certain it is that Dr. McGee attained a very notable measure of success with the minimum of formal education."

The great epoch of my brother's life — his intellectual awakening — dawned at a very early age. Even in childhood he showed the first signs of it: the desire to know; the wonderment at what the world is; his curiosity about books; the deep wish to know about uncivilized and barbarous peoples and their ways; about countries and their peculiarities, their differences and similarities. He at-

tended school in the little red school-house of our district only during three or four months of the winter terms. At best these schools in those days furnished only the simplest rudiments of learning and the knowledge was imparted without the least regard to the proper training of the mind. Our mother, as was indicated before, loved to read good literature and she always managed to have plenty of up-to-date periodicals, magazines, and books in the house. Much as she desired it, she could not give each member of her very large family scholastic advantages of a superior kind, but she encouraged individual effort, to which W J particularly responded. His oldest brother, George Henry, who I said was educated at Cornell College, undertook the instruction of his learning-thirsty brother during the years 1867 and 1868. He soon recognized the superior intellect of the boy and always spoke of him as an exceedingly apt scholar, acquiring knowledge easily and retaining it into what was afterwards developed into a really marvelous memory. He took up the study of Geometry and unaided he demonstrated every proposition and solved every problem in the book, a feat which his college-bred brother could not do, as he frankly acknowledged, though there were none of his classmates better in that branch than he. Don surely "stamped improvement on the wings of time." When attending school, while the other boys, during the intermissions, were out upon the school ground romping and playing, he remained in the house working out examples or studying some branch of learning not usually taught in the schools of the country. He was not one of the kind to waste energy. We often read of young men almost killing themselves in their efforts to excel in baseball, football, or, as was the case in Don's early days, of demonstrating their

ability to ride a bicycle at the rate of a mile in less than a minute. At that time bicycle racing was the rage as automobile speed is today. He did not deny that it might be a fine thing to ride a bicycle at that wonderful rate of speed, or to excel in games, but he thought and showed by his life, that if these young men had enough good sense and ambition, it would be better to use part of so much arm and leg ability in pulling up the weeds which grow everywhere in such abundance — in vacant lots, on road-sides and other places, or in hoeing corn, shelling beans, or some other really useful employment. He claimed that the energy wasted in so-called "sports," athletics and various other ways, if usefully directed would lift every poor family in the country from want to comfort; it would furnish every widow a home and every child that is poor with bread and an education. Unrestrained play, he granted, is necessary for the young growing child, but in the case of big boys and men, physical exercise for the health, if the mind were so inclined, could be obtained from some pleasant, well-directed work.

From 1867 to 1874, W J devoted all his spare time at home to intense study. During this time, he studied Latin, higher Mathematics, including Astronomy and Surveying, and he also became proficient in German. His brother George and a maternal uncle rendered him valuable service in his study of land surveying. Our father was much interested, then, in the practical education of his boys. Going to town one day he brought back a compass saying the whole family should now learn to survey. Don also studied law and from 1871 to 1876 he was engaged in land surveying and justice court practice. He was considered an excellent surveyor and his services were eagerly sought by neighbors and even by strangers at a considerable dis-

tance from home. In a few of these places he had some queer experiences: At one time he was called upon by an old bachelor to survey his fields. W J was ravenously hungry when mealtime came, but when he sat down at the table to eat, the old bachelor's cats and dog jumping on the table and even eating out of the same dishes set before him, his hunger suddenly disappeared and the old bachelor made the remark, "I never saw a man walk so far, work so hard, and eat so little." Our own home was never over nice in appearance, for our mother had a very large family to look after and she was passionately fond of reading and as a natural consequence first class order did not always reign throughout the house; but we managed to keep things pretty clean and we made a distinction between the brute animal and the human, considering the latter a little superior to the former, and providing separate places for the lower animals to eat and sleep. Don never considered his law practice or his land surveying business of much importance in his plan of life and they were soon laid aside.

From a boy Don was always very ambitious, not only in study, but also to attain ideals which he had placed before himself. As he grew older this ambition became almost boundless. Our mother felt herself called upon to curb this overmastering passion. A magazine containing some lines from one of her favorite authors, Joaquin Miller, was brought and placed before him to read, and as he read aloud the lines:

"Better it were to sit still by the sea
Loving somebody and satisfied;
Better it were to grow babes on the knee,
Then wander and wander in all these ways,
Land forgotten and love denied."

He exclaimed, "O, take it away, take it away, I'll have none of it." The rigid system of self-culture which he pursued through life was the outgrowth of this ambition, as well as his intense interest in things, an interest which we noticed even when he was at home, as being one of the leading elements of his life.

One of his doctrines in reference to study was that no one could do good mental work unless he had plenty of sleep. If he stayed up until midnight or later studying, which was often the case, he would remain in bed sleeping during the morning hours. One fine summer morning about eight o'clock, he came down stairs rubbing his eyes. Noticing the lateness of the day he said, "A fool bird kept me awake last night with its singing." Mother replied, "It was seven o'clock this morning when that 'fool bird' began its carolling. Your knowledge of birds ought to teach you that they do not wake up at night to sing."

In 1901, in recognition of his distinguished attainments, the Doctor's degree was conferred upon him by Cornell College, Iowa, at which time he presented a comprehensive essay on the "Beginnings of Mathematics."

I am of the opinion that Don never won any laurels for being a good penman. He usually wrote a plain, fairly legible hand, as good I am sure, as most people of the present day. But if Grandfather Anderson were living now, he would probably count all his achievements as of little worth, because his penmanship did not come up to the standard of perfection prized by the old man. I am sure of this for Don received the following card from his uncle, W. I. Anderson, son of our grandfather, in which he reprimands his nephew for his poor penmanship. If the son could find fault and reprove, what would the man of an earlier generation, and one more concerned about this branch, think of it?

Peosta, Iowa, Jan. 11, 1879.

DEAR NEPHEW:—Your card found us about as usual. I am truly shocked at your careless chirography, especially when you write a card. It is almost inhuman to postmasters and their clerks since it is their duty to read all the cards lest something vulgar may be written on them. We will keep that “curby” stone on the mantel for you and two or three thousand and more up in the library, or at least as many of them as you want.

Yours truly,

WILLIAM I. ANDERSON.

From the latter part of the letter above, it will be seen that Don, in these early knowledge-seeking days, was eager to obtain any information about the things that interested him so much and from the large number of cards and letters received (a few of which I copied below), I infer that all to whom he made appeal for aid most graciously responded. Many men, too, occupying high positions in state and nation, hearing of his efforts or reading his articles published in the local papers, sent words of commendation and encouragement, which could not be otherwise than very gratifying to the young aspirant.

San Springs, Iowa, April 22, 1878.

DEAR SIR:—I am sending you that tooth tonight. Parties in Monticello who have seen it think it to be the tooth of an extinct race of wild horses that once inhabited the country perhaps in prehistoric times.

G. BROWN.

Epworth, Iowa, May 1, 1878.

W. J. MCGEE:—I am informed that one mile east of Peosta, Iowa, in the Illinois Central Railroad quarry, thirty feet from the surface may be found petrified animal remains

and also some very fine crystals. It would probably be well worth your while to make a thorough investigation. Specimens are plentiful.

W. McKEE.

Fayette, Iowa, April 1, 1880.

W J MCGEE:—This is a good point to “geologize” from. If you care to “bunk” with a Methodist preacher, make your stay with me. Prof. Bissell of Fayette University will be glad to have you here.

D. M. PARKER.

Dubuque, Iowa, March 10, 1878.

DEAR SIR:—I have read your article on the “Formations in Northeastern Iowa,” with much interest. Will have them preserved in the Archives of the Institute.

ASA HORR, M. D.

Des Moines, Iowa, March 8, 1878.

MR. W J MCGEE:—Have just read your article on the Climatic Difference of the Hemispheres and am greatly pleased with it. Let me know when you write newspaper articles lest some may escape me.

[HON.] FRED. O'DONNELL.

House of Representatives,
Washington, D. C., Oct. 27, 1877.

W J MCGEE,

Farley, Iowa.

Referring to your letter relating to the publication of the Territorial Surveys, etc., I have to say the works are very valuable, much sought after, and quite difficult to obtain. I have the promise that you shall have a copy.

T. W. BURDICK.

The following petition was gotten up and presented to the Iowa State legislature by my brother along in the seventies. Little attention was paid to it at the time. The farmers, then, as compared with the present, received ridiculously low prices for all sorts of farm produce and they could not pay taxes except for the really necessary, practical, and material things. The matter has since been attended to and the departments are in the Science Hall of the State University of Iowa.

PETITION

FOR THE ESTABLISHMENT OF A STATE CABINET

To the General Assembly of Iowa

WHEREAS, There has never been made in Iowa any complete and general collection of specimens illustrating the Natural History of our State, and

WHEREAS, We deem it essential to the best interests of the State that such a collection should be made and kept at some point accessible to the citizens and students of the State University, therefore,

WE THE UNDERSIGNED CITIZENS OF would respectfully ask that a State Cabinet of Natural History be established at Iowa City, in connection with the State University of Iowa, having for its objects:

1. The collection, preservation, and exhibition of specimens illustrating and representing the native animals and plants of the State both past and present,

2. The collection, preservation, and exhibition of typical and unique relics of the prehistoric inhabitants of the State, together with such plans of their works as may be of assistance in determining their habits, customs, and ethnic relations;

3. The collection, preservation, and exhibition of specimens illustrating the natural, mineral, and other resources of the State; and,

4. The general diffusion of information upon all subjects connected with such a collection.

He also presented a bill to the State legislature about this time, asking for appropriations for State Geologic Survey. The letter appended will show the result of this bill:

Senate Chamber, Des Moines, Iowa, March 13, 1880.

W. J. McGee, Esq.,

DEAR SIR:—The committee on appropriations has reported back your bill, with the recommendation that it be indefinitely postponed, which is the polite way of killing it.

I talked with the members of the committee about it and they tell me the entire committee was in favor of the objects of the bill, but they recommended as they did, simply because they do not have the money now for such purposes and probably will not have it until the new capitol building is out of the way. All highly approve the idea of the bill.

M. M. HAM.

When my brother was about twenty-one he went to Nebraska on one of his student outings. There he noticed that the lark sang a different song from the larks in Iowa. He could not account for the difference so he wrote to the late Charles Darwin in regard to it. Mr. Darwin could not explain the cause but he wrote a very interesting letter (now lost) thanking Don and saying the information would be useful to him.

A letter from T. W. Reute, then a prominent citizen and scientist of Dubuque, now deceased, also gives an idea of Don's methods of obtaining knowledge and disseminating it, showing that he did not live to himself alone, nor did he get knowledge to hoard it up for selfish purposes.

Dubuque, Iowa, July 25, 1878.

MR. W J McGEE: Your kind note, describing the family of humming birds and offering them to me, is received. I thank you, sincerely, but we have no way of keeping them and they would probably die before reaching here. If you will send me the nest and the branches on which it is fastened, after the birds have flown, I shall be much obliged to you and shall place them in the museum of our Institute here.

Yours very truly,

T. W. REUTE.

Mr. Reute was a member of the National Geographical Society and widely known.

CHAPTER VI

MARRIAGE

On Saint Valentine's day, February 14, 1888, W J was united in marriage to Miss Anita Newcomb, the daughter of the most distinguished astronomer of his time. Mr. Newcomb was of German descent. His talents were recognized and fully appreciated in the land of his forefathers. The last time he was in Germany, he was entertained at luncheon by Emperor William, the present Emperor's father. Miss Anita Newcomb's wedding dress was designed by William Dean Howells, who with Mrs. Howells was among the guests at the wedding.

W J's wife is a woman of extraordinary brilliant intellect. Her early education was obtained in private schools in Washington. She then spent three years abroad in special study. After her marriage she studied medicine in Columbian College, Washington. This was before that institution had closed its doors to women. She then took a post-graduate course at Johns Hopkins. She practiced in Washington with marked success from 1892 to 1896. She was director of the D. A. R. Hospital Corps, from April to September, 1898, which corps selected the women for army and navy service. August 29, 1898, she was appointed acting assistant surgeon of the United States army, being the only woman to hold such a position; assigned to do duty in the surgeon general's office in charge of army nurses' corps, which she organized. When the United States Congress approved this work by making the nurse corps of trained

women a permanent part of the army, the pioneer stage was passed and she resigned December 1, 1900.

In 1904, acting as president of the Society of Spanish-American War Nurses and as representative of the Philadelphia Red Cross Society, and by agreement with the Japanese government, she took a party of trained nurses, formerly in the United States army, to serve in the Japanese army for six months gratuitously. She was then appointed by the minister of war as superior of nurses, which placed her in the same rank with officers of the Japanese army. She inspected and reported on the relative nursing conditions. She was made the recipient of the Japanese Order of the Sacred Crown, a special Japanese Red Cross decoration, and two Russo-Japanese war medals. She is a member of the "Association of Military Surgeons of the United States," and of "Spanish War Veterans," and of these she is the only woman eligible.

She has delivered lectures in various parts of the United States and, during the year 1911, she lectured on Hygiene in the University of California. She has also written able articles for various magazines.

There can be no question that Mrs. McGee was very helpful to her husband, and that she contributed not a little to his success in the various fields of labor to which he was called. Shortly after their marriage she and her husband made a trip from New Orleans northward on horseback to make a geologic survey of the country. She was his companion, too, on the way to the hot desert region of Arizona, where he went, partly for rest and recuperation from disease, but mainly for the purpose of studying up the fundamental principle of vegetal life in desert countries and the processes by which the cacti, the mesquite trees, and the creosote bushes utilize energy from light.

Two children remain from this union: Klotho, the older, (Donald, the second, having died in infancy), and Eric Doolittle Newcomb, who is still a boy in school at Chestnut Hill Academy, near Philadelphia. Klotho visited us quite often, and when she came she made long stays, and consequently we know more about her, and the many things she said and did while with us are indelibly impressed upon my memory. The first time she came to see us was before she was a year old and she then remained from April to October. Her nurse brought her from Washington, but when they were here awhile the nurse was taken sick and obliged to return home and soon after she died. The child remained. Although we employed another nurse, the grandfather took upon himself to take most of the care of the child whom he fairly worshiped as he did all the other grandchildren who lived near and that he knew. Our cows were all good, strong, healthy animals; but father set aside the milk of a beautiful, young heifer, which was to serve as nutriment for Klotho. The tender, solicitous oversight of the old man for the tiny babe was touching in the extreme. He would lull her to sleep and when she woke up, he was at hand to feed, amuse, or comfort her. He tried to teach her to walk and to talk, and every day he carried her up stairs to show her Don's picture, to ask her whose it was, and to teach her to kiss it. The child, too, loved the old grandfather, preferring his company to that of any other members of the household. When the mother came to take her back to Washington, it was necessary to try on a pair of shoes, and while this was being done, she would permit no one but grandpa to hold her.

When she was six years of age she came again to spend the summer with us. At this time the old man was sleep-

ing in the family graveyard; but the child could walk and talk now and was also able to take care of herself. She seemed to me to be well-disciplined — better than children usually are at that age. She was very interesting, contented with everything, and generally obedient. At that time I had a pup about a year old. She and the dog were fast friends. Neither had reached the age of reason, so one day they both climbed into the hog pen and managed to kill one of the little pigs. I was angry and in reprimanding her, I rashly promised I would whip her if she went into the pen again. I supposed of course she would not think of disobeying. A few days after she and the dog strolled again into the yard and killed another pig. According to my promise I was obliged to whip her and the dog. There were no more pigs killed, but the dog often seemed to try to coax her into the sty, going in himself and barking lustily while looking at her as much as to say, "Come on, let's have some more fun;" but he did not dare to harm the animals himself. When he did this Klotho would call out with a loud voice, "Aunt Emma, the dog is killing pigs," wanting me to understand that she was not implicated with the dog in any more misdemeanors. A short time after this she hurt her finger and she came to me for sympathy. "It is too bad, dear," I said. "It hurts more than the whipping Auntie gave you, doesn't it?" "O, yes, indeed," she hastily replied, "the hurt from the whipping went right away, but my finger hurt stays a long time." This whipping often worried me. My oldest brother, George, always maintained that correcting children by means of the rod was a barbarous custom and I shared this opinion with him. After she was married, in writing to her, I happened to think of the mode of punishment I had employed so many years before and I told her I al-

ways felt sorry for giving her that whipping, that it was not necessary. With her usual delicacy and goodness of heart she said, since she has children of her own she finds it is sometimes necessary to use the rod and that in her case I should not worry as to whether it was necessary or not.

There were three things that Klotho at this early age said she was possessed not to do: to take a bath, to say her prayers, and to wear a night-gown when she went to bed. As to the last, I heard her father, W J, when he was quite young, trying to demonstrate to mother on scientific principles why it was hard upon the system to change one's underwear in winter, but mother paid no attention to his lucid reasoning on this matter, but insisted upon the garments being changed with the usual regularity.

Klotho's grandmother was past eighty-two years the last time she saw her and of course she was greatly changed and extremely forgetful. The child could not understand why this was so. At different times she would ask Klotho the same questions about the same things. One day, losing patience by being thus interrogated so often, she exclaimed, "Grandma, I don't see what makes you forget so; I have told you about that seven times today already." Another time we were all seated about the fire when grandmother began belching. Hearing this a few moments the child sprang up saying, "Why, Grandma, please excuse me!" "What for?" innocently asked the aged grandmother. "Why, for that hiccough, or belching, or what ever you call that noise you are making." "Oh! please excuse me," said the grandmother very complacently; but in two minutes she would forget to ask to be excused and the little girl had to make the same reprimand.

Of all the phenomena of nature, Klotho, while with us, seemed to be more taken up and impressed by the blue

vault of the heavens, making me think she was a born astronomer like her Grandfather Newcomb. She loved to gaze at the stars on clear, moonlight nights and her frequent exclamations were, "Isn't it beautiful up there! What a big round moon! How the stars twinkle tonight!" The following summer she spent at the seashore. In writing to her Grandmother McGee from there, she said, "O, Grandmother, you just ought to see the sunsets on the ocean. You have no idea how lovely they are."

Klotho now resides in San Francisco, Cal. She is the wife of David Madison Willis. The Madisons and Willises are old and distinguished families of Virginia. She has two children, Newcomb Madison Willis and David Madison Willis, aged eighteen months and four months respectively.

CHAPTER VII

W J'S LIFE WORK

W J's first point of observation after leaving the farm was on the Indian Mounds near Dry Hollow in Dubuque county, Iowa, not far from Farley and near his home. These mounds were carefully studied, engravings were made from them, and articles written about them for the press.

When Hunter's Cave, in Jackson county, was discovered, he made a journey there to explore that underground formation. The night was spent in admiring and investigating the wonders of the cavern. An interesting description of the cave appeared in the *Farley Advertiser*, the editor of the paper then and now, Mr. Chas. A. Joseph, having accompanied W J on this exploration tour.

From 1875 to 1877 he studied geology and archeology. I do not know what was the incident that first claimed his attention and stimulated his interest in what was to be one of the dominating activities of his life. Between 1877 and 1881 he made geologic and topographic surveys of northeastern Iowa. This work is said to be the most extensive ever made in America without public aid. "He began the work several years before the United States government learned of his true worth," says an article in one of the Dubuque newspapers at the time of his death. Mr. Knowlton gives an account in his excellent memoir of the work executed by W J in this region. "The glacial mantle which so completely covers Northeastern Iowa, offered many, then, unsolved problems, and together with his brothers, he ex-

plored with keen interest the numerous caves about their home and studied the peculiar rocky topography with more than boyish interest. He read widely of such books and papers as were then available on glaciation and its phenomena, and began independent observations which soon brought him into contact and communication with other workers in his field. The fact that he joined the American Association for the Advancement of Science in 1878 (twenty-seventh meeting at St. Louis, August, 1878), enrolling himself in the section of Geology, shows that his interest was even then crystallizing along these lines. So far as learned, his first scientific paper, "On the Relative Position of the Forest Bed and Associated Formations in Northeastern Iowa," was published in 1878 and it was the forerunner of many of like import.

Between 1877 and 1881, he prosecuted as a private enterprise, a topographic and geologic survey of some 12,000 square miles of territory in northeastern Iowa though the full results were not published until 1891.

His first work under Federal auspices was a report on the building stones of Iowa, prepared for the tenth census in 1880, though not published until four years later. This, but more particularly his careful work on the multifarious phenomena of glaciation in the Upper Mississippi Valley had attracted wider attention and in July, 1883, he was called to the United States Geologic Survey, then under the directorship of Major J. W. Powell. In a very short time he was placed in charge of the division of the Atlantic Coastal Plain geology. Though then but thirty years of age, he came not as a mere tyro or dabbler in geology, as might be presumed from his previous isolation, but with an astonishing breadth of view and maturity of judgment, and within the next ten years he erected a foundation which

must ever be considered by any who would study the geology of the Coastal Plain. This decade, 1883-1894, covers the period of his most intensive constructive geological activities.

From September 28 to October 4, 1885, he was present at the Congrès Géologique International, at Berlin, having been sent as a delegate from the United States. He resigned from the Geologic Survey on June 30, 1893, to assume on the following day the position of ethnologist in the Bureau of American Ethnology, to which department he had accompanied Major Powell. One year later he became ethnologist in charge of the Bureau, and continued in this position until July 31, 1903, when he resigned to assume charge of the Department of Anthropology of the St. Louis Exposition where he brought together an unprecedented assemblage of the world's peoples. At the close of the St. Louis Exposition he became first director of the St. Louis Public Museum, continuing in the position from 1905 to 1907. On March 14, 1907, Theodore Roosevelt created an Inland Waterways Commission, and at the first meeting of this Commission, W J McGee was elected vice-chairman and secretary, a position he continued to fill until his death. About the same time (March 23, 1907), he was appointed as an expert in soil waters in the Bureau of Soils, United States Department of Agriculture, and in that position he also continued until his death. He surveyed and mapped out 300,000 square miles in southeastern United States and completed a geologic map of the United States and New York, and in 1888 he investigated the Charleston earthquake.

Aside from the honors and responsibilities which came with a busy official life, many additional honors were conferred upon him. He was one of the principal founders of

the Columbia Historical Society; president of the American Anthropological Association, of the Anthropological Society of Washington; of the National Geographic Society, and of the American Association for the Advancement of Science (1897). He was senior speaker in the Department of Anthropology at the World's Congress of Arts and Sciences in 1904, and non-resident lecturer on Anthropology at the State University of Iowa.

Mr. Knowlton further says, "In the field of Pleistocene geology of the Upper Mississippi Valley, W J McGee was a pioneer. At the time he began his studies very little was known of the glacial history of this region and he did much to establish a knowledge of the succession of invasions and recessions of the ice-sheet and while many of his conclusions have been subject to revision in the light of fuller modern investigations, much of his work remains and must remain, as a basis upon which subsequent knowledge is to be builded.

"His most notable contributions to American geology are, of course, in the Atlantic Coastal Plain. In this plain, Dr. McGee's name with three others — Hilgard, Smith and Dall, must ever be associated. These men have laid the foundation, however much it has been, or in future will be modified, upon which all subsequent work must be erected. In this particular phase of the subject which W J McGee has made his own, he was again a pioneer. He saw and appreciated the broad problems of stratigraphic continuity and succession, of continental elevation and depression, and he set about their solution. His work was distinctively constructive and as such finds a permanent place in American geologic history. While certain of his conclusions, as is almost always inevitable in pioneer work, have been modified or revised, the broad, fundamental generalizations remain as an essential basis for later students.

"After an interval of a dozen years or more following the close of his studies on Coastal Plain geology, during which his attention was mainly occupied in the field of ethnology, he again returned to the consideration of certain, collateral, geological problems. It had come to be the fancy in certain quarters that the removal of the forest or vegetal covering had little or no influence on the run-off, of surface waters. His report on 'Soil Erosion' published as a Bulletin of the Bureau of Soils in the United States Department of Agriculture, is a complete and graphic refutation — if such were really needed — of this contention. His last work completed less than a month before his death and also to be published as a bulletin of the Bureau of Soils is an elaborate study of subsoil water and its essential relation to agriculture.

"Of his anthropological and ethnological work only the briefest mention can be made. While much of his time was given to administrative work, he nevertheless found opportunity for a number of studies, perhaps the most notable being a study of the Seri Indians, a fierce, previously unstudied tribe, inhabiting certain islands off the coast of Lower California.

"He did much for the Geological Society of America. He was one of the founders and served for four years as its editor, establishing the *Bulletin*, its official publication, on the high plane it then and since then has maintained. His constant attendance at the meetings during the earlier years of the society's existence will be recalled, as well as his contributions to many notable discussions of geologic problems.

"W J is said to have been a very helpful man ever ready with counsel and information to assist whomsoever might come to him. To the younger men he was especially con-

siderate and helpful, drawing freely upon his vast store house of information, without thought or regard for personal credit. When the so-called conservation movement was launched a few years ago, the exigencies of public life made it impossible for full credit to be given to all who had a guiding hand in the work, but from one, in a position to know, it appears that the success of this movement was in a large measure due to the far-sighted, comprehensive policy and sterling advice of W J McGee. Many of the activities of the Inland Waterways Commission, of which as already mentioned, he was the vice-chairman and secretary, were due to his energy and initiative. Laborious statistical tables were compiled and scattered information brought together in a usable form. During all these later years, although not engaged in active geological investigations, he was always willing and anxious to discuss the newer results in the several fields and to accept without question or resentment those which offered a surer solution than any he himself had proposed."

Mr. Knowlton speaks of him as a man of commanding presence, one who would attract attention in whatever assembly he might find himself. Although seemingly somewhat formal in address to those not intimately acquainted with him, he was, nevertheless, a man of cordial, sympathetic manner and could command the respect and deference of all with whom he came in contact.

Mary Proctor, too, the daughter of Richard Proctor, the eminent astronomer, said at the time the American Association for the Advancement of Science met in Boston, that W J McGee was the most striking man on the rostrum. Mary Proctor was, herself, a well known lecturer. At the time of the World's Fair she lectured in Chicago and subsequently in other cities throughout the United States.

CHAPTER VIII

DEATH

W J McGee died at Washington, D. C., September 5, 1912, at the age of fifty-nine years. All too soon, it seems to me, to complete the work he probably planned in early life to do. From his age at the time of his death, one could have expected

“The best is yet to be, —
The last of life for which the first was made.”

It is a lamentable loss to the world that so many whose knowledge and experience eminently fitted them for responsible work and for doing great good for many years, are prematurely cut off from their usefulness. As one advances in life it is easier to carry on work than to begin it. There is less power for initiative though not less for patient endeavor. Starting in life, as my brother did, with something that is sure to interest and employ his later years, and noting the advancement made in it, when more time is found, which is apt to be the case in old age, he could pursue it with greater advantage to himself and profit to the world.

Cancer, that dreadful scourge of the human race, sapped the foundations of his strength and caused his death. During the many years that he was afflicted with the insidious malady, he made a special study of his own case, noting its every symptom, “setting down calmly and imperturbably the progress of the disease from its first inception in

1894 to its obvious dominance in April, 1912," and thinking a knowledge of these symptoms, etc., in his case might prove a benefit to others similarly afflicted, he wrote his last article, for the good of humanity, as he probably hoped, which he styled "Symtomatic Development of Cancer." This article was published in *Science*, September 13, 1912, a few days after his death.

It is said that during the progress and culmination of the disease, W J exhibited the most remarkable courage and fortitude. "It appears that for the last fifteen years of his life, his work — some of it the most exacting of his career — was carried on in the impending shadow of certain dissolution, much of it at the last under the stress of acute physical suffering, but there was no slighting, no faltering, no repining."

I knew my brother was ill the summer before he died, and in August, I wrote to him asking him to come home and let me take care of him, for it seemed to me in the quiet and peace of the old homeland, he might rally and the ravages of disease might be stayed for a few years at least; but he wrote me that he was too ill and weak to be moved, and a few weeks later word came that he was dead. About one and a half years before death came he was operated on at Garfield Hospital for the trouble but he received only temporary relief and during the last summer of his life, he slipped, one day in leaving the Cosmos Club where he was staying, wrenching his knee and severely straining himself. This brought on a severe renewal of the old malady and he never left his room after being carried there.

Many grateful words of sympathy, letters of condolence, and tributes to his memory came to the old farm home, at his death, from those who knew him personally, from some

who knew him from reading his works, and even from a few who knew him only by reputation. Among those of his readers is Rev. Sipko Francis Rederus, formerly pastor of the Presbyterian church at Farley and now helping to minister to the spiritual needs of the people of Milwaukee, Wisconsin, who composed a few lines as a tribute to his memory which I here insert.

A TRIBUTE TO W J MCGEE

Reared in a cottage in the woods,
By nature taught in nature's grove;
He loved her sweet companionship;
With her in early days did rove.
He traced for us through rocks and sands
And clay, the age's wandering course;
And led us through time's labyrinth
To transformation's greatest source.

He read for us in burial mounds
Of grand, old Mississippi's vale,
Where sleeps a strange and vanished race,
Their weird and fascinating tale.
He led us to the distant haunts
Of men that have survived the past,
For whom the touch of culture now
Forbids their laws and ways to last.

And as he leads us on and on,
Sweet fancy does for us unfold
Scenes wonderful, sublime, and weird —
The prehistoric world of old.
There poets, glorious visions see,
And scientists, a guiding light,
And men, who feel within their souls
God's wisdom, majesty, and might.

Our guide has left for worlds unknown,
But he will live for aye in story,
And on the rocks and sands and clay
Will ever live his name in glory.
And thousands following in his tread
In future ages will behold
The scenes that fascinated us
And more of that strange world of old.

My brother gave all his time, his mind, and strength, while living, for the benefit of science. When he realized that death was claiming him as her victim, and he could do no more, having in view the thought that everything possible ought to be done for the cause of medical science, he willed his body to the medical college at Philadelphia.

In accord with the terms of the will which prescribed funeral rites, services were conducted Thursday, September 5, 1912, at the home of Gifford Pinchot and the body was then shipped to Dr. Edward Spitzker, brain specialist of Jefferson Medical College, for study under the surgeon's knife.

The terms disposing of his property were brief. With the exception of a few remembrances to his children and close, personal friends, he bequeathed all his personal belongings to his wife, Mrs. Anita Newcomb McGee. He was more explicit in disposing of his body and prescribing the manner of funeral services which he desired. In relation to the latter the will reads: "Impressed by the needless burden of mortuary observances in every stage of human development, I desire and direct that no funeral ceremonies, save of the simplest character, be held over my remains."

To Klotho, his daughter, now Mrs. Willis, he gave a gold watch; to Eric Newcomb, his son, a silver watch was given;

Gifford Pinchot received a rifle and an agate button tray and the Cosmos Club where he stayed, the mounted head of a Texas steer. Colonel H. C. Rizer, chief clerk of the geological survey, was the executor of the estate. The will is dated June 27, 1912, and was witnessed by Robert T. Hill, Mrs. H. C. Kennedy, and M. W. Patterson.

Although according to the will the brain alone was to be conveyed to Dr. Spitzka, Colonel Rizer, before the death of W J, arranged for the brain specialist to accept the entire body and have the dissection of the torso and limbs made by other surgeons, connected with Jefferson Medical College.

I quote Dr. Edward Spitzka from a reprint taken from the *American Anthropologist*, Vol. 15, Number 3, July-September, 1913:

DEATH MASK OF W J M'GEE

"More than a decade ago, when the writer was requested to make a study of the brain of Major J. W. Powell, the late W J McGee whom I then met for the first time, signified his most earnest intention to bequeath his own brain and body to scientific purposes. This was in 1903. Although making no mention of it at the time, he was aware of symptoms, which he subsequently associated with the cancer that caused his death, and concerning which, he wrote an antemortem note, published in the magazine entitled *Science*, U. S. xxxvi, pp. 348-357. On the approach of his death, in personal letters and through his friends, Dr. W J McGee reiterated his wish, and formulated the following bequest in his testament:

Pursuant to an intention fixed in early manhood, on learning that a certain state provided by law that medical graduates should have dissecting room experience and yet made no provision for the requisite

subjects; conformably with the shocking economic waste represented by the cities of the dead in the long settled portions of the country; and in accordance with my custom of devoting myself and my efforts to the public, I give and bequeath my body for the purpose of dissection to any medical college selected by my executor; except that my brain go, with that of the late Major J. W. Powell (now in my possession), to Dr. E. A. Spitzka, of Jefferson Medical College, Philadelphia, Pennsylvania, for study and preservation at his discretion. . .

"Dr. McGee's body was received by me at the Daniel Baugh Institute of Anatomy on September 5, 1912, the day of his death. It had been embalmed and the tissues were in a good state of preservation. In compliance with Dr. McGee's wishes a series of observations were begun, and after an interruption, due to my illness, have been resumed.

"The brain on removal weighed 1410 grains (49.73 oz. avoir.) or about 60 grains above the average of the same age. The important measurements of the head were:

"Circumference 58 cm.

"Ear to ear over vertex 38 cm.

"Max. antero-posterior diam., 19.1 cm.

"Max. transverse diam., 16 cm.

"Cephalic index, 83.77 cm.

"The detailed findings concerning the cerebral morphology and the pathologic manifestations are being studied and recorded, but these, as well as appreciation of Dr. McGee's life work, must be deferred to a later publication.

"Dr. McGee's recognition of the need of studying the brain of intelligent persons, as well as the need of affording every opportunity for the prosecution of research into obscure pathologic manifestations as exemplified in cancerous growths, is noteworthy even in this assumedly enlightened age. It is a legitimate claim of science that all persons, particularly those of superior intellectual capacity, permit

themselves to become available for scientific study immediately after death. It is true that anatomical material is now furnished to most medical schools, but never in abundance, and always derived from pauper institutions and in varying degrees of morbidity and dissolution. Concerted action among cultured people yielded some fruitful results in the Mutual Autopsy Society of Paris, the Cornell Brain Association, and the American Anthropometric Society.

"Dr. McGee's example, it is to be hoped, may encourage others to do likewise. EDWARD ANTHONY SPITZKA,

"Jefferson Med. College, Philadelphia, Pennsylvania."

Memorial services in honor of my brother's memory were held in Farley, Iowa, on Friday, January 16, 1914, a partial account of which I copy from the *Farley Advertiser*:

"Memorial services to the late Dr. W J McGee were enjoyed by a packed house Friday night. Eminent speakers from abroad who had known him from a scientific standpoint were present.

"The house was filled at an early hour and much interest was shown all through the exercises. The services were opened by the singing of the hymn, 'Lead Kindly Light,' by the double quartet, Messrs. Berry, Stuntz, Payne, and Gibbs, and Mesdames Stuntz, Ransom, Berry, and Miss McDonough of Dubuque. Invocation was said by Father Leen which was followed by a paper read by Rev. C. B. Stuntz giving the historical career of Dr. W J McGee from boyhood to the end of his days.

"The first speaker to be introduced was Dr. Guthrie of Dubuque who said in part that in all ages men had been hero worshippers. We have but to read in the history of the past or to travel the world over to be made fully conscious of this fact. In the days that are past, and not so

very far distant, the hero that was honored and praised — that was enshrined in the hearts and minds of his countrymen, was the hero of the battlefield. We see evidences of this hero worship in the monuments and statues that have been reared in countless numbers to men like Alexander the Great, Julius Cæsar, and Napoleon Bonaparte, men who had sacrificed thousands upon thousands of human lives for the gratification of their inordinate ambitions. This form of hero worship, however, is a thing of the past. Today a new form has arisen. The honor and praise of the modern world is given less and less to men who shed the blood of their fellowmen. The type of the hero that today is drawing the worship of the world is that of Edward Jenner, the man who discovered after years of experimentation, the vaccine which was the cure for smallpox; or that of Pasteur who by his investigations and research brought to light the principle of infection and the means of preventing it; or, again, that of Behring who, one eminent authority has said ‘achieved the greatest victory that has occurred in science in the last fifty years,’ when he gave to the world an antitoxin for diphtheria. We honor today those who sacrifice themselves for mankind. Dr. W J McGee has shown himself to have been a man of this mold — eager to widen the bounds of knowledge.

“Professor Thomas Macbride, now president of the State University of Iowa, was next introduced and said:

“We do well to honor our great men. This northeastern portion of Iowa has her full share — Allison, Henderson, Larrabee, Caloni, and McGee. I, myself, knew Dr. McGee for a long time. He was a man of striking appearance, great force of character, full of nervous energy, and tremendously devoted to the cause of knowledge. He began his work here in northeastern Iowa giving such a remark-

able analysis of the geological structure of this region as has never been equalled. The first time I met him was when he came to Iowa City to appear by invitation before the Academy of Science. This was in 1878. He came striding into the room, a vigorous, sturdy young man with a great shock of black hair. We thought him rather eccentric, but before long his marvelous diction and rapidity of thought made us soon feel that he was the real scholar among us all.

"In 1881 Major Powell took the post at the head of the United States geological survey. Major Powell was a one-armed soldier who had lost his arm at Shiloh and after the war had taken a boat and with some hardy companions, had followed the Colorado river in all its length, the first white man to accomplish this feat. The first man called to his assistance was from Farley — W J McGee. The task that was assigned to him was to give an account of what is known as the Potomac formation, a formation that runs from a little south of Trenton, N. J., to Georgia. He walked over the whole area and gave an account of the formation that is a classic in scientific knowledge. About ten years later he went with Major Powell into the department of ethnology. It was an entirely new field for him, and he was a little fearful as to the outcome of changing base at his time of life. But he was faithful to his trust, and nearly sacrificed his life, in giving the world a thorough investigation of the Seri Indians, the most savage of all the tribes on this continent. Throughout his entire life he showed the boundless energy, the indomitable determination, and the love of his work that brought him to the very highest circle of American scientists. He worked to enlarge the boundaries of human knowledge. There are men who give to the world better corn or wheat. They have done a

great thing. But there is a greater hunger than that for bread alone — the hunger of the mind for knowledge. It was to satisfy this hunger that Dr. W J McGee toiled until the very last.

CHAPTER IX

EXTRACTS FROM WRITINGS

Thinking it might be of interest to the relatives and friends of W J McGee and also others who may read this brief biography and who may not have easy access to his numerous written articles, scattered as they are through so many magazines, official reports, and other publications, put in public libraries and other places throughout the United States, to read something from his pen, I insert a few extracts, which may not be the most interesting, most scientific, or best of his works, but which will give perhaps an idea of his style of writing in the purity and precision of diction, the clearness and vividness of description, the interest and strength of narration, the careful attention to necessary details, and the general and pleasing harmony which pervades the whole.

IN THE DESERT ¹

My residence in the desert from May 20 to September 1, has been one of the most delightful of my life. I have been alone except for an Indian boy, and my longest expedition from camp was a walk of forty miles across the desert to meet my wife, who stopped at the nearest railroad point for a visit.

The life, remote from humanity, was not undertaken by

¹ Reprint from the *Independent*, San Francisco, wherein W J McGee gives his experiences while in search of health in the hottest regions of Arizona.

me as a hermit whim, or even solely to gratify my natural fondness for the desert. The strenuous work of building up the department of anthropology for the Louisiana Purchase Exposition — showing our half of the world how the other half lives — had come soon after an attack of typhoid fever, from which I did not take time to recuperate fully. I found myself burdened by certain of the sequelae of typhoid, a condition that might be relieved temporarily by drugs, but that could not be cured in that way. So I set about to seek for some regimen that would meet the requirements of my system.

Since I had lived in deserts to some extent and had acquired that peculiar affection for the desert which binds the Arab to his home and which leads all people who live in the desert to fall in love with it so that they can hardly reconcile themselves to live anywhere else, I naturally thought about arid regions. I began to realize that the best possible regimen would be exposure to the extremely strong sun and the extremely dry air of the desert, both of which tend to stimulate the skin and other external tissues more than any other known agencies.

The point which I selected possesses historic interest. Long before Columbus came to this country, the aborigines of the southwest journeyed occasionally from what is now Sonora, Mexico, into what is now California, and in so doing they had to traverse deserts and seek for water. They discovered two or three water-pockets — Tinajas Altas or "High Bowls," as the Mexicans call them — at a point in what is now the Gila range of mountains, about seventy-five miles on an air line southeast of Yuma and about one and one-half miles from the international boundary between Mexico and the United States.

That watering place became sacred to the Indians. Al-

though they never resided there, they visited the place in their journeys and carved a vast number of inscriptions on the granite rocks about the water hole. These consist usually of votive inscriptions which note the passage of a particular group of Indians and take the form of the totemic animal of the group—the mountain sheep, the coyote, the antelope, the rattlesnake and many other animals that were the totems or tutelaries of the tribes.

Just what white man first saw the Tinajas Altas cannot be positively stated, but there is every probability that this man was one of the greatest Jesuits in the history of Western America, Padre Kino, the man who discovered that California was not an island, as it had been regarded for many years, through a curious blunder on the part of map-makers and geographers. Padre Kino went from portions of Mexico included in what is now the state of Sonora to the Colorado River, and he described the geography of the region with a good deal of accuracy.

Another chapter was opened by the discovery of gold in California, and when the golden germ invaded the brain cells of Mexicans as well as Americans, the Argonauts began to flock across the plains and the desert to California. The favorite route for the Mexican gold seekers and one of the routes for the Americans lay by way of Tinajas Altas, along the old missionary trail.

The gold seekers were followed by pioneers, and both gold seekers and pioneers often died on the way from thirst and hardship and occasionally they were massacred by Apache Indians. Each new party sometimes had to bury the bodies of the preceding party. The whole ninety miles from the last water of the little Indian village of Quitovaquito to Tinajas Altas is almost a continuous cemetery.

I had been down in Sonora in 1899 to look for a tribe

of Indians that I found extinct, and I concluded to go to the Colorado River and observe the Cocopah Indians. Thus I obtained my first knowledge of Tinajas Altas, and thus I now sought Tinajas Altas as a health cure. The hopes which I entertained last spring have been more than justified. The effect of desert life on my health has been all that I anticipated, and I return to civilization entirely well and with a store of experiences well worth the trouble of securing.

From Yuma a man with a strong team and a light vehicle took us — that is, myself and José, my Indian boy, and our rations and blankets — out to Tinajas Altas. Our rations for each month were twelve pounds of raw bacon, eleven pounds of raw navy beans, two pounds of rice, four pounds of sugar, and one pound of tea, a total of thirty pounds — a pound per day — for each of us. The merit of the navy bean is that each pound when cooked absorbs so much water that it becomes from five to eight pounds. In spite of the experiments of military organizations all over the world in the last quarter of a century, no rations in a condensed form have been found equal to the good old frontiersman's standby of bacon and beans.

I had no tent or other bar against nature, nor did I desire one. I liked the sky above me, and as the average rainfall is only about one-half inch per annum, I needed no protection from the wet. It was, of course, cold at night. The ground was, therefore, more comfortable to sleep on than a bed or cot, because it became heated during the day and at night gave off warmth. Lying flat on the ground was a great deal warmer than I would have been on a bed even as low as six inches above ground. The diurnal range is very great at Tinajas Altas, as in all extremely arid regions, and this is one of the most arid in

the world. The ordinary temperature, as nearly as can be measured, ranges from 40 to 50 degrees at night to between 110 to 135 degrees in the day.

For cooking my meals, I found sufficient roots and twigs of the mesquite and creosote. It does not take much fuel to raise water from 100 degrees at which it averages here to the 200 degrees at which it boils at the Tinajas Altas altitude of 1400 feet.

I took no reading matter with me. It was to be a time of resting. But I did some thinking in the way of studying the fundamental principle of vegetal vitality in deserts, the process by which the cacti, the mesquite trees, and the creosote bushes, utilize energy from light.

I found more life than I anticipated — two rattlesnakes, four centipedes, half a dozen scorpions, tarantulas, and two Gila monsters, mostly in camp. Many birds and insects and some big-horns shared the water with us. I did not shut them out, although water was scarce. Only two Tinajas remain, one containing perhaps 250 gallons of rather bad water, the other with about fifty gallons of fairly good water, and more in the sand. Each basin was an hour's climb (round trip) from camp. I am inclined to think the place is a sort of spring, drawing supply from the ground water in the granite rocks.

On July 20, I had the exciting experience of rescuing two Mexican prospectors at the point of death from thirst. They had gone out insufficiently supplied with canteens, boastful of their ability to stand heat and thirst. Five days later they straggled back to camp, semi-delirious, neither one able to articulate. They dropped fifty yards apart, and José attended one and I looked after the weaker, administering water and a little whisky, giving also, a heart stimulant to the weaker one, to keep the thickened

blood moving until the reaction was over. Glimpses of that side of life are awful but happily one can provide against such emergencies.

THE CONSERVATION OF NATURAL RESOURCES ²

In all ages and lands men have moved against winds and currents, and so westward and inland. In a word, human progress is a tale of conquest; and part of the tale was told in America.

Even in the Prime, when mankind was just becoming human, man made the greatest industrial advance in all his history — no so little thing as the control of steam, but that earlier mastery which opened the way to all arts and crafts — the Conquest of Fire. To those who know the ways of primitive thought it is clear that the Promethean gift was no chance spark caught in the lucky tinder, and came not without generations of association in which fire was made both animate and deific — not, indeed, without habitual contact with volcanic flow and slowly cooling lava. Now our own West, with one of the two greatest lava fields of the globe (the other that of central France) and its scattered flows, gave the American Aborigines opportunity, and all of them mastered fire, five centuries before Columbus. Man's second greatest industrial advance was no so little thing as harnessing electricity, but was the painfully slow and mystery-burdened mastery of the sharp edge — the Conquest of the Knife. This was made in many lands during the ages, but it was caught in the making only in California and on neighboring coasts. The next industrial stride spanned no so narrow chasm as that of wireless

² Reprint from *Mississippi Valley Historical Proceedings*, 1909-1910.

transmission, but stretched over the first mastery of elasticity — it was that of the Conquest of the Spring, still under way in Mexico when Cortez came. The fourth industrial advance in order, and the second in magnitude was no so small a thing as railway or steamship, but arose in the sluggish and faith-guided mastery of the principle of rotation which made these possible — the Conquest of the Wheel. This was indeed made independently in the Old World, where it was perfected by the aid of draft animals; yet it remained for our own West to reveal the way of its making under the patient processes of primitive philosophy, a philosophy always conceived in the uncanny and born in mystery.

Many minor advances, too, have come out of our West: the Conquest of Corn, the romance of the vegetable realm; the Conquest of Beasts (the dog and guanoca and turkey and others), with the worshipful lore of the animal realm — these and others came not through the swift and facile Minervan birth of invention, but only through that tedious travail in which the hand leads and the mind lags behind. Of such were the gifts of the West unto the East even among the Aborigines; they all marked Conquest over Nature; and they grew up and were given freely by virtue of the strenuous life arising in a region of stressful extremes — for in the primal periods of humanity's youth, no less than now, the softer impulses of stressless means lead men to eat lotus and loll their lives away leaving little mark on the face of nature or the scroll of time.

Now the line between the East and West is a shifting one. When the Nation was young, New York and Pennsylvania were western states; then Ohio became the Far West and Indiana an Ultima Thule, while the Empire and Keystone commonwealths became Middle States. Now the Mississippi is an eastern river; Kansas and Nebraska and

the Dakotas are the actual Middle States; and the Pacific States are the West — with a new Far West away beyond in Hawaii and the Philippines; in every stage of settlement from the eastern flanks of the Appalachians to the western face of the Rockies and the foot-slopes of the Sierra the geographic and climatal means tended toward extremes, and thus toward more stressful experiences among settlers; and so the West, drawing its blood and bone and brawn from the East, has repaid in brain and brain-wrought Conquest over Nature. "Westward the course of empire takes its way," wrote a good bishop on the shores of Long Island Sound; yet the Star of Conquest ever shines most brightly eastward whence the initial impulse came. How different the course of Conquest would have been had the Pilgrims entered the Golden Gate in lieu of landing on Plymouth Rock, none may say confidently; yet it is easy to see that had this happened the American pioneers would have begun and continued their Conquest with a vastly higher appreciation of natural values than that implanted on the Atlantic Coast.

The four greatest steps in Man's industrial progress since humanity began being those marking Conquest over Fire, Knife, Spring, and Wheel, the single step remaining to be taken before Man becomes master over Nature is no so small a thing as the navigation of the air, which marks merely a new application of primary principles, but so great a thing as the Conquest of Water — a step no less sweeping and cosmic than the Conquest of Fire, and one which will be made perfect only when Water is not merely guided and directed in movement, but actually drawn from the materials of Nature at human behest as to time and place and quantity, much like the fires used now in the arts and crafts. Some desert animals certainly, and many desert

plants presumably, are able to convert other substances into H_2O and CO_2 , that is, into Water with an equivalent of carbonic acid passing off into the air; and since Man may always do better what lower nature can do at all, scientific prevision finds herein some basis for forecasting a full Conquest of Water, when cacti and agava and other desert plants are selected and Burbanked and improved in such wise as not only to sustain themselves in richer luxuriance but yield enough water over to sustain a human population! Whether the provision of science be justified, time will tell; and the question may be raised, whether the spirit of diviner prophecy hovered over Bishop Berkeley when he wrote:

“Westward the course of empire takes its way;
The four first Acts already past,
The fifth shall close the Drama with the day;
Time’s noblest offspring is the last.”

Assuredly, water is our primary and chiefest resource as the source of life itself; assuredly the most strenuous experiences of our settlers in arid regions arise in the strife for water; and assuredly if the settlements of our country had begun in the arid West our standards of thought, our laws, and our practical concepts would have been more trenchant and far wiser than the slovenly notions and practices imported from a mother-land where water so abounds that it is felt a burden rather than a benefit — a bane rather than a boon. Even as it is, our clearest concepts of equity in water resources are out of the west, — our justest decisions perhaps from Arizona, and our completest water statute from Oregon. . . .

When Independence was declared and the Constitution was framed, no resources were reckoned except the Men who

made the nation and the Land on which they lived. The very munitions of war, like the tools and utensils of peace, were mainly imported. Meanwhile the trees of the centuries-old forests were deemed obstructions to settlement rather than values in themselves; and the most strenuous work of any people in any country in all the world's history up to the middle of the nineteenth century was that performed by the pioneers in destroying the magnificent forests of the western frontier in Ohio and neighboring States — a work that bent the backs, though it did not break the spirits of eastern-born men and women as they felled trees, burned logs, and grubbed stumps in clearing their homesteads.

Now because the Fathers saw Land as the sole natural resource of the country, so the succeeding generations remained indifferent to the values residing in the minerals below and the forests above, and parted with all together as acres or "sections" of land. Herein lay what now seems the most serious error in the world's greatest Republic. Monarchs are accustomed to retain royal or imperial rights in the forests and the minerals; ecclesiastic institutions allied with monarchical rule have commonly held rein over rarer resources until they were reclaimed by the growing generations of men; but through a lamentable lack of foresight our Republic hastened to give away, under the guise of land to live on, values far greater than the land itself, and this policy continued for generations. Men still living remember when the finest coal fields of the then western States of Pennsylvania and Virginia were sold as mere lands, with no added price for the coal beneath or the wood above; their sons remember when the iron ranges of the newer West in the Lake Superior region and in Alabama were transferred at the lowest government figures for land, with

no added rates for the vast mineral wealth; and even younglings well recall the sale of fine woodlands at the conventional farm-price of \$1.25 per acre — and that, too, when each tree of the hundred or two standing on each acre was worth more than the acre-price!

The policy of free-giving grew into a thoughtless habit, and this into a craze which spread apace; swamp lands in millions of invaluable acres were unloaded on States on terms seldom taken seriously, and their title in turn was often allowed to pass virtually without consideration; empires in extent of lands rich in forests and minerals were given outright to corporations for promoting transportation when a hundredth or even a thousandth of their prospective value a half-century later would have been more useful; states and cities followed the national lead, and all manner of franchises — rights of way, water rights, and the rest — were given for long terms or in perpetuity to all comers, generally without money and without price. In all the world's history no other such saturnalia of squandering the sources of permanent prosperity was ever witnessed! In the material aspect, our individual liberty became collective license, and our legislative and administrative prodigality grew into national profligacy; the balance between impulse and responsibility was lost, the future of the People and the Nation was forgotten, and the very name of posterity was made a by-word by men in high places; and worst of all the very profligacies came to be venerated as law and even crystallized foolishly in decisions or more questionably in enactments — and for long there was none to stand in the way of the growing avalanche of extravagance. The waste was always wildest in the West, for as settlement followed the sun new resources were discovered

or came into being through natural growth; yet at last even the vigorous West was awakened, and that largely through the reckless alienation of land.

The policy of the free gift of land grew out of the Fathers' dream of a freehold landed citizenry, with each citizen the head of an independent family. Now the extension of the free giving to other values than those of land itself led to both good and evil results, not foreseen before the collateral values came into being through the natural growth and orderly development of our People. The free gift of minerals and forests opened for foresighted men ways to wealth and power beyond all historical precedent; and so America became a manufacturing nation, rich and powerful among the world's nations, with unexampled rapidity. At the same time the free gift of these resources—having no value in themselves apart from that given them by the growth of the People—opened the way to monopoly, and the resources passed under monopolistic control with a rapidity never before seen in all the world's history; and it is hardly too much to say that the Nation has become one of the Captains of Industry first, and one of the People and their chosen representatives only second. With the free gift, under the title of land, of resources far exceeding the land in value, the aspiration of the Fathers for a land of free families failed; for the mineral-bearing and wood-bearing lands were devoted to mining and milling and manufacturing instead of homes, and the People became in large measure industrial dependents rather than free citizens.

So far have these changes gone that it is a question whether a majority of our electorate is not today in a condition of industrial dependence akin to that of the yeomanry and peasantry in days of feudalism; and it is beyond ques-

tion that some of the most important social and political problems now confronting us are due to the passing of that industrial and social independence which the Fathers sought to establish through a freehold landed citizenry, and which scarcely survives save in our rural districts. It was told of old that the camel begged his Arab master to admit his nose into the warm tent for protection against wind and cold, and that when this plea was granted the shaggy head and ears and the snaky neck and then the stout shoulders and the rest of the body followed, until the sheik himself was pushed out into the storm; and verily our People and their chosen representatives, who warmed the breath of the subalterns of industry in their youthful weakness, may well take warning! . . .

When the Nation was young its area was small; but successive additions of territory were made on the West — the ever growing new West — affording new frontiers for pioneering and final conquest, until the area of mainland United States came to approximate two billion acres. A third of this area is arid; and a quarter-century ago John Wesley Powell — soldier, scientist, philosopher, a western man in breeding and spirit — saw that the public lands available for individual settlement under the original plan were nearly exhausted, and conceived the idea of virtually extending the public domain by making the arid lands available for settlement through irrigation; and, as Director of the Geologic Survey, he initiated practical work in that direction. It was characteristically a task of the West! Meantime the forests were still passing under the destructive fire and wasteful axe, until a practical Prophet of the Forest appeared in the person of Gifford Pinchot — born and bred in the East but receptive of the spirit of the West; one styled a “brilliant dreamer,” though better described

as a modern Ajax — who boldly conceived the patriotic plan of protecting the country's forests for the country's benefit. . . The work of both went forward slowly, but both projects became epoch-marking. In good time came Theodore Roosevelt, in whom East and West met in ceaseless struggle for supremacy, making him the typical American of his generation, and as President he not only sustained the Forest and Reclamation Services, but pushed on towards the reclamation of the rivers for navigation and other uses, an effort for which his hands were held up by many. . . Pinchot and Garfield especially, and Roosevelt in his turn sought to counteract the tendency toward wholesale alienation of the public lands for the benefit of corporations and the oppression or suppression of the settler; and in the end their efforts resulted in what is now known as the Conservation Movement: a movement leading through a Waterways Commission, a Conference of Governors in the White House, a Conservation Commission, and a dozen congresses and conventions — though none the less the offspring of a few far-seeing minds and a gift of the dynamic West to the waiting East.

The National Conservation Commission made an inventory of the country's resources, the most comprehensive ever prepared in any land. At the current increasing rates of consumption and waste, our forests would last twenty-five years; our high grade iron ores (of which we mine annually some 1300 pounds for each man, woman, and child of our population) would be gone by the middle of the century and the low grade ores by its end; our coal (of which we consume some five tons per capita yearly) would last well toward the end of the next century. . . Of our two billion acres of land, about one-third is virtually unproductive by reason of aridity, in another third the rainfall is less

than is required for full productivity in the present state of agriculture; some two-fifths of the whole is occupied by farms, and about one-fifth is actually farmed.

Our stock of water (inventoried for the first time by the Commission) is supplied by rain and snow, and is equivalent to ten Mississippi Rivers flowing constantly at the average rate. . . . Water is the leading food for man and beast and plant. An average adult can subsist on two hundred pounds each of meat and bread yearly, but must supplement this solid food with about two thousand pounds of water; the grain for the bread requires for its growth four hundred tons of water, and the animals yielding the meat require for drink and food about four thousand tons; so that the direct and indirect yearly consumption of water by the average adult inhabitant is fully four thousand, four hundred tons. . . . When our population reaches a billion, as it will in normal course in three centuries, our entire natural water supply will be required to sustain it, though its density will then average but three hundred and twenty per square mile in lieu of the six hundred and forty it could sustain if the limit lay in the land alone — the limit already reached by Belgium. Meantime, our waters are not only ill-utilized, but wantonly wasted; allowed to run off in destructive floods, to become contaminated at appalling cost of life, to erode the soil and carry off its richest part, and thus to limit navigation and other uses. . . . On the basis of the inventory of resources, the National Conservation Commission framed a conservation policy and defined plans for carrying it out. . . . On its face, the Commission is material — ultra-material. At first blush the moral and the social in which cults arise and from which doctrines draw their inspiration may not appear. Yet, in truth, there never has been in all human history a popular

movement more firmly grounded in ethics, in the eternal equities, in the divinity of human rights! Whether we rise in the spiritual empyrean or cling more closely to the essence of humanity, we find our loftiest ideals made real in the Cult of Conservation. We merely lay stepping stones toward the brink of the chasm before us when we declare: No forests, no streams; no iron, no ships; no coal, no power; no farms, no food — for these verities are but seed of thought and feeling. What boots it to us — to look and feel further — that we have two billion acres of land, when we have water enough for but half of it? . . . What boots it that we are ninety millions strong, when hardly nine millions are independent electors, with something like an equal number annually selling their birthright of free citizenship for messes of monopoly pottage if not for the very wherewithal to eat and wear? What boots it to us that we have wood and coal to burn wantonly, as Nero in the Ancient City, while other foundations of the house of the Nation are crumbling? What boots it to us, indeed, that America is rich and powerful among the nations when she has become so through fattening on the very sources of life and when the wealth and power are virtually gathered into the hands of some seven Captains of Industry, leaving the rest of the ninety millions only the poorer?

Nor is this all: What *right* has any citizen of a free country, whatever his foresight and shrewdness, to seize on sources of life for his own behoof that are the common heritage of all; what *right* has court or legislature to aid in the seizure; and striking still more deeply, what *right* has any generation to wholly consume, much less to waste, those sources of life without which the children or the children's children must starve or freeze? These are the questions arising among intelligent minds in every part of this coun-

try, and giving form to a national feeling which is gradually rising to a new plane of equity. The questions will not down. Nay, like Banquo's ghost they tarry, and haunt, and search! How shall they find answer? The ethical doctrine of Conservation replies: by a nobler patriotism, under which the citizen-electors will cleave more strongly to their birth-right of independence and strive more vigorously for purity of the ballot, for rightness in laws, for cleanness in courts, and for forthrightness in administration; by a higher honesty of purpose between man and man; by a warmer charity, under which the good of all will more fairly merge with the good of each; by a stronger family sense, tending toward the realization of the rights of the unborn; by deeper probity, maturing in the realizing sense that each holder of the sources of life is but a trustee for his nominal possessions, and is responsible to all men and for all time for making the best use of them in the common interest; and by a livelier humanity, in which each will feel that he lives not for himself alone but as a part of a common life for a common world and for the common good. All this may be old, but it is none the less timely today. It was better expressed in an utterance of two millenniums past—"A new commandment give I unto thee that ye love one another." But can a decree lose its occasion until it is obeyed?

. . . The hope of the Fathers for a freehold citizenry joined in equitable and in indissoluble Union is not fully attained. The American Revolution was fought for Liberty; the American Constitution was framed for Equality; yet that third of the trinity of human impulses without which Union is not made perfect—Fraternity—has not been established: full brotherhood among men and generations has not yet come. The duty of the Fathers was done well according to their lights; but some new light has come

out of the West where their sons have striven against Nature's forces no less fiercely than the Fathers against foreign dominion. So it would seem to remain for Conservation to perfect the concept and the movement started among the Colonists one hundred and forty years ago — to round out the American Revolution by framing a clearer Bill of Rights. Whatever others there may be, surely these are inherent and indefeasible: —

1. The equal rights of all men to opportunity.
2. The equal rights of the People in and to resources rendered valuable by their own natural growth and orderly development.
3. The equal rights of present and future generations in and to the resources of the country.
4. The equal rights of citizens to provide for the perpetuity of families and States and the Union of States.

The keynote of all this is Fraternity. They look to the greatest good of the greatest number and for the longest time; they are essential to perfect union among men and states; and until they are secured to us we may hardly feel assured that government of the People, by the People and for the People shall not perish from the earth.

ANTHROPOLOGY AT THE LOUISIANA PURCHASE EXPOSITION ³

The motive of the department was to diffuse and incidentally to increase knowledge. Hence, the primary purpose was essentially educational; and the work of the department was distinctive, if not unique, in that it embraced research in a degree comparable with that accorded to original work in modern institutions of higher learning.

Anthropology is the science of man. In the broad sense

³ Reprint from *Science*, U. S., Vol. xxii, No. 573, December, 1905.

it deals with all mankind and their attributes. Its aims and purposes are connected with man as an organism, and as the type of the class of living things, distinguished by mentality; also it deals with man as an assemblage of varieties or races and as social creatures united by language and law and organized in families, communities, societies, commonwealths and nations. In like manner the science in its broader aspects deals with man as a producer or creator of artificial things, and so as a progressive power in the conquest of lower nature; and in its highest aspect the science deals with the development of both man and his works, and seeks to trace the paths of human progress not only in the interest of definite knowledge concerning our own kind, but in the hope of wider guidance toward future progress.

Such, in brief, is the broad science of anthropology; and of such were the field and the motives of the department.

II

Practically, the field of anthropology is divided among several sub-sciences, each pertaining to a class of human attributes: (1) the science or sub-science of man considered as an organism, or as the highest genus and species of the animal realm, is called physical anthropology or andrology; its object-matter is the individual human organism, or anthropos; it embraces anatomy and physiology, and is closely related to the beneficent sciences connected with medical theory and practice.

(2) Of late, the science of the human mind and of man as an organism dominated by mental power is called psychology; its subject matter is the psyche, individual and collective; it deals with the brain and nervous system considered in relation to bodily movements and actions, both individual and collective; its methods embrace the comparison of the characters of individuals and classes ascer-

tained thereby; . . . it is related to the most important directive and repressive instrumentalities of modern life, including education, alienism and social regulation.

(3) The still broader science of the human activities, or of man as a producer or creator, and also of human productions, is commonly known in its descriptive aspect as demography and in its systematic aspect as demology; its object-matter is the demos, or artificial group; it deals with what men do; and with an important class of activities, viz., arts, sciences, industries, languages, laws, and philosophies.

(4) The science of man considered as an assemblage of races is known as ethnology; its object-matter is the natural group of mankind defined in terms of physical, of mental, or of activital features or of these combined. In its descriptive aspect, it is known as ethnography.

(5) The several sciences dealing with man and his works touch that development of mankind, in which lie the chief interest and value of anthropology; for whatever the immediate aims, it is the ultimate aim of the science to trace the course of human progress and classify individuals and peoples in terms of that progress, and thus to learn so much as may be of the origin and destiny of mankind. Up to the present, the field of systematic knowledge dealing with the progress of mankind has not been clearly defined; for ever since Darwin and Huxley and Haeckel discussed the evolution of man, a third of a century ago, this has been the frontier of anthropology, the campus of the leading pioneers, the virgin soil of teeming yield whence the richest fruits of each passing decade are gathered. Naturally, in view of the vigorous vitality symbolized by the Universal Exposition of 1904, the virile subject of human progress formed the leading motive of the department of anthropology — the exposition, indeed, affording the world's finest

opportunity for framing the science and setting it on a firm basis. The objects-matter embrace the generations, families, stocks, and races of men, with the human activities and products in their endless variety; the methods comprise observations and comparisons of growth, heredity, viability, fecundity, and development by exercise and cultivation, together with manufacture and other forms of production. Its leading divisions are: (1) archeology, or the science of human relics, with human paleontology covering fossil and other remains of prehistoric man, and the paleography, dealing especially with ancient writings; (2) history; and (3) the unclassified and nameless body of knowledge concerning current conditions and events in the human world. . . .

The general view of human development opens a vista extending so far into the past and so widely into the field of man's activities that the recorded history of any particular province or people seems small in comparison; yet the history of a people or province forms an effective introduction to the full history of mankind; accordingly, the written history of the Louisiana Purchase gave a keynote for the department and the exhibits were chosen and arranged in consonance with this view. Here, too, the work was made feasible by the coöperation of liberal institutions and individuals, chiefly by historical societies and working historians. The nucleus was the collection of the Missouri Historical Society, illustrating by manuscripts and books, relics and portraits, maps and sketches, every important step in the development of the metropolis of the Louisiana Purchase Territory and in the growth of the commonwealth with which it has come up; also illustrating by aboriginal relics the protohistoric development of the district from the times of aboriginal settle-

ment, the building of earthen tumuli and temples, the growth of a primitive agriculture, and the advent of the bison and its hunters into the period and through the centuries of discovery and acquisition and industrial conquest by white men. A supplementary illustration of development and conquest from the aboriginal condition to that of a great commonwealth comes from the Iowa Historical Department; and collections serving to fill in the details of the general outline were exhibited by the Franco-Louisiana Society, the Louisiana State Historical Society, the Chicago Historical Society and other coöperative exhibitors. . . .

The relics and records indicate that a leading factor in man's development is unification and interchange of knowledge. At first slow and inimical and effected chiefly through strife and conquest, the interchange and unification of the higher stages is rapid and amicable—schools replace armies, confederation supplants conquest, and the white man's burden of the ballad becomes the strong man's burden in the political family of nations as in the personal family of kindred. . . . The means and ends of purposive interchange and unification as applied to the American aborigines, and the actual processes illustrated by living examples, were exhibited in the typical Indian school forming the most conspicuous feature of the department. Here parents still clinging to native customs and costumes delighted in the progress and achievements of their children in the arts and industries and even in the language and letters required by modern life; here the aboriginal maker of moccasins showed (and saw) the contrast between his craft and modern shoe-making; here the actual transformation from comfortless camp life into comfortable householdry was illustrated, not only by every intermediary step, but by the actual passages of individuals and families from one stage to the other during the exposition period; . . .

here, indeed, was illustrated in epitome, and also in the actual progress accelerated by purposive coöperation, a considerable part of that course of intellectual development which raised man from dull-minded and self-centered tribal existence into the active and constructive and broad-minded life of modern humanity.

VI

In a word, the motive and scope of the anthropological department were to show our half of the world how the other half lives; yet not so much to gratify the untrained curiosity which leads even the child to look with wonder upon the alien as to satisfy the intelligent observer that there is a course of progress running from lower to higher humanity and that all the physical and cultural types of man mark stages in that course.

THE SERI INDIANS ⁴

Something has been known of the Seri Indians (Series, Ceres, Ceris, Heris, Tiburones), since the time of Coronado, yet they remain one of the least studied tribes of North America. . . . They are a distinctive tribe in habits, customs and language inhabiting Tiburon Island, in the Gulf of California, and a limited adjacent area on the mainland of Sonora, Mexico. They call themselves *Kun-kaak* or *Kmike*; their common appellation is from the Opata, and may be translated "spry." Their habitat is arid and rugged, consisting chiefly of desert sands and naked mountain rocks, with permanent fresh water in only two or three places; it

⁴ The complete article may be found in first part of the *Seventeenth Annual Report* of the Bureau of American Ethnology to the secretary of the Smithsonian Institute — 1895-96.

is barred from settled Sonora by a nearly impassible desert. Two centuries ago the population of the tribe was estimated at several thousands, but it has been gradually reduced by almost constant warfare to barely three hundred and fifty, of whom not more than seventy-five are adult males, or warriors.

The Seri men and women are of splendid physique; they have fine chests with slender but sinewy limbs, though the hands and especially the feet are large; their heads, while small in relation to stature, approach the average in size; their hair is luxuriant and coarse, ranging from typical black to tawny in color, and is worn long. They are notably vigorous in movement, erect in carriage, and remarkable for fleetness and endurance.

The Seri subsist chiefly on turtles, fish, mollusks, water-fowl, and other food of the sea; they also take land game, and consume cactus fruits, mesquite beans, and a few other vegetal products of their sterile domain. Most of their food is eaten raw. They neither plant nor cultivate, and are without domestic animals, save dogs, which are largely of coyote blood.

The habitations of the Seri are flimsy bowers of cactus and shrubbery, sometimes shingled rudely with turtle-shells and sponges; in some cases these are clusters pertaining to matronymic family groups; in other cases they are isolated, and are then often abandoned and re-occupied repeatedly, and are apparently the common property of the tribe. The habitations afford some protection from the sun and wind, but not from cold and wet, which are hardly known in winterless and nearly rainless Seri-land.

The Seri clothing consists essentially of a kilt or skirt extending from waist to knees; sometimes a pelican-skin robe is worn as a blanket or mantle, and used also as bedding;

the head and feet, as well as the bust and arms, are habitually bare, though a loose-sleeved wammus reaching not quite to the waist is sometimes worn. These garments were formerly woven of coarse threads or cords made from native vegetal fibres; the belt is generally of twisted human hair, of horse hair, of dressed deerskin, or of snake skin; the robe consists of four, six, or eight pelican skins sewed together with sinew. The pelican-skin robes are still used, though the original fabric is commonly replaced by cotton stuffs obtained through barter or plunder. Cords of human hair and skins of serpents are still used for necklaces.

The sports and games of the Seri Indians include racing and dancing, and there are ceremonial dances at the girls' puberty feasts, accompanying the rude music of improvised drums. Decoration is ordinarily limited to symbolic face-painting, which is seen especially among the females, and to crude ornamentation of the scanty apparel. A peculiar pottery is manufactured, and the pieces are sometimes decorated with simple designs in plain colors.

The bow and arrow are habitually used, especially in warfare, and turtles and fish are taken by means of harpoons, shafted with cane and usually tipped with bone, charred wood, or flotsam metal. The arrows are sometimes provided with chipped stone points, though the art of chipping seems to be accultural and chamanistic. The ordinary stone implements are used for crushing bone and severing sinew or flesh, and also for mulling seeds and other food substances; they are mere cobbles, selected for fitness, and retained only if their fitness is increased by the wear of use, after the manner of protolithic culture. Graceful balsas are made from canes, bound together with mesquite fibre-cords; and on these the people freely navigate the narrow

but stormy strait separating Tiburon and the neighboring islets from the mainland. They make a distinctive pottery, which is remarkably light and fragile. Its chief use is carrying water to habitations (always located miles from the spring or tinaja) or on desultory wanderings. Shells are used for cups and to some extent for implements. They have a few baskets which are not greatly different from those made by neighboring tribes.

The modern Seri are loosely organized in a number of maternal groups or clans, which are notable for the prominence given to mother right in marriage and for some other customs; and there are indications that the clan organization was more definite before the tribe was so greatly reduced. The leading clans are those of the Pelican, the chief tribal tutelary, and the Turtle, a minor tutelary. At present polygamy prevails, professedly and evidently because of the preponderance of females due to the decimation of warriors in battle; but both custom and tradition tell of former monogamy, with suggestion of polyandry. The primary marriage is negotiated between the mothers of the would-be groom and the prospective bride; if the mother and daughter of the latter family look with favor on the proposal, the candidate is subjected to rigorous tests of material and moral character; and if these are successfully passed, the marriage is considered complete, and the husband becomes a privileged and permanent guest in the wife's household. Family feeling, especially maternal affection, is strong; but petty dissensions are common save when internal peace is constrained by external strife. The strongest tribal characteristic is implacable animosity towards aliens, whether Indian or Caucasian; certainly for three and a half centuries, and probably for many more, the Seri have been almost constantly on the warpath against one alien group or

another, and have successfully stayed Spanish, Mexican, and American invasion. In their estimation, the brightest virtue is the shedding of alien blood, while the blackest crime in their calendar is alien conjugal union.

The Seri vocabulary is meager and essentially local; the kinship terms are strikingly scanty, and there are fairly full designations for food materials and other local things, while abstract terms are few. Two or three recorded vocables seem to resemble those of the Yuman languages, while the numerals and all other known terms are distinct. The grammatical construction of Seri speech appears not to differ greatly from that of other tongues of Sonora and Arizona; it is highly complex and associative. The speech is fairly euphonious, much more so than that of the neighboring Papago and Yaqui Indians.

The Seri Indians appear to recognize a wide variety of mystical potencies and a number of zoic deities, all of rather limited powers. The Pelican, Turtle, Moon, and Sun seem to lead their thearchy. Creation is ascribed to the Ancient of Pelicans—a mythical bird of marvelous wisdom and melodious song—first raised Isla Tassne, and afterwards Tiburon and the rest of the world, above the primeval waters. Individual fetishes are used, and there is some annual ceremony at the time of ripening of cactus fruits, and certain observances at the time of the new moon. The most conspicuous ceremony is the girls' puberty feast. The dead are clothed in their finest raiment, folded and fastened in small compass like Peruvian mummies, placed in shallow graves, and covered with turtle shells, when the graves are filled with earth and heaped with stones or thorny brambles for protection against beasts of prey. Fetishes, weapons and other personal belongings are buried with the body, as well as a dish of food and an

olla of water, and there are curious customs connected with the place of sepulture. There is a weird, formal mourning for dead matrons, and suggestions of fear or veneration for the manes.

Seriland is surrounded with prehistoric works, telling of a numerous population who successfully controlled the waters for irrigation which were very scant, built villages and temples and fortresses, cultivated crops, kept domestic animals, and manufactured superior fictile and textile wares; but (save possibly in one spot) these records of aboriginal culture cease at the borders of Seriland. In their stead a few slightly worn pebbles and bits of pottery are found here and there, deeply imbedded in the soil and weathered by the suns of ages. There are also a few cairns of cobbles marking the burial places, and at least one cobble mound of striking dimensions but of unknown meaning; and there are a few shell-mounds, one so broad and high as to form a cape in the slowly transgressing shore-line (Punta Antigualla), and in which the protolithic implements and other relics are alike from the house-dotted surface to the tide level, ninety feet below.

The absence of relics of a superior culture, and the presence of Seri relics throughout deposits of high antiquity, suggest that the tribe is indigenous to Seriland; and this indication harmonizes with the peculiar isolation of the territory, the lowly culture and warlike habits of the people, the essentially distinct language, the singular marriage custom, and the local character of the beast-gods. All these features combine to mark the Seri as children of the soil, or autochtones.

The present knowledge of Seriland is based primarily on the work of two expeditions by the Bureau of American Ethnology; and secondarily, on researches into the car-

tography and literature (descriptive, historic and scientific) of the region. Both of the expeditions were projected largely for the purpose of making collections among little known native tribes in the interests of the National Museum, and the general ethnological inquiries were ancillary to this purpose. The first of the expeditions was in 1894 and the second in 1895. . .

The location of Seriland, the home from time immemorial of the Seri Indians, lies in northwestern Mexico, forming a part of the State of Sonora. It comprises Tiburon island, the largest and most elevated insular body in the Gulf of California, together with a few islets, and an adjacent tract of mainland; the center of the district being marked approximately by the intersection of the parallel of 29° with the meridian 112° . The territory is divided by the narrow but turbulent strait, El Infiernello. It is bounded on the west and south by the waters of the gulf with its eastward extensions to Kino Bay, on the east by an almost impassable desert, and on the north by a waterless stretch of sandy plains and rugged sierras fifty to one hundred miles in extent.

Tiburon island is about thirty miles in length from north to south and ten to twenty miles in width; its area, with that of the adjacent islands or islets, is barely five hundred square miles. The mainland tract held by the Seri is without definite boundary; measured to the middle of the limiting desert on the east and half way across the waterless zone on the north, its area may be put at 1,500 square miles. To this land area of 2,000 square miles may be added the water area of the strait, with its northern and southern embouchures, and the coastwise waters habitually navigated by the Seri, as far as Kino Bay, making half as much more of water area. Such is the district which the Seri claim

and seek to control, and have practically protected against invasion for nearly four centuries of history and for uncounted centuries of prehistory.

Seriland forms part of a great natural province lying west of the Sierra Madre of western Mexico and south of an indefinite boundary about the latitude of the Gila River, which may be designated the Sonorian province, and it is allied in many of its characteristics to the arid piedmont zone lying west of the Andes in South America.

The Sonoran province is notably warm and dry. The vapor-laden air-currents from the Pacific drift across it and are first warmed by conduction and radiation from the sun-scorched land, to be chilled again as they roll up the steeper roof-slope to the crest; and the precipitation flows part way down the slopes, both eastward and westward from the Sierra Madre — literally the Mother (of waters) range. A climatal characteristic of the province is two relatively humid seasons, coinciding with the two principal inflections of the annual temperature-curve, i. e., in January-February and July-August, respectively. In the absence of meteorologic records the temperature and precipitation may be inferred from the observations at Yuma and Tucson, which are among the warmest and driest stations in America, or indeed, in the world. The ordinary midday temperature of these places may be estimated at about 110° in the shade. The night temperature at the same season, is usually 50° to 75° , though during two-thirds of the year it is liable to fall to or below zero. The sun temperature is high in comparison with that measured in the shade, the exposed thermometer frequently rising to 150° or 160° , according to its construction, while black-finished metal becomes too hot to be handled, and dark sand and rocks literally scorch unprotected feet. The leading characteristic of the tempera-

ture is the wide diurnal range and the relatively narrow annual range; another characteristic is the uniformity, or periodic steadiness of the maxima, coupled with the variability and non-periodicity of the minima.

The precipitation in Sonoran province is chiefly in the form of rain; in the winter humid season snow falls frequently on the Sierra Madre and rarely on the outlying ranges; in both humid seasons (and in humid spots at all seasons) dew forms in greater or less abundance. Fog frequently gathers along the coast, especially during the winter and in the midsummer wet season and sometimes drifts inland for miles. The greater part of the precipitation is in local storms, frequently accompanied by thunder — gusts, or sudden tempests, though cold drizzles sometimes occur, especially at the height of the winter humid season. Except where the local configuration is such as to affect the atmospheric movements, the distribution of precipitation is erratic, in both time and space; some spots may receive half a dozen rains in a year, while other spots may remain rainless for several years; and the wet spot of one series of years may be the dry spot of the next. . .

The configuration and climate combine to give distinctive character to the hydrography of the Sonoran province. The melting snows and more abundant rains of the Sierras form innumerable streams flowing down the steeper slopes toward the piedmont plains, or soak into pervious rocks to reappear as springs at lower levels; sometimes the streams unite to form considerable rivers flowing scores of miles beyond the mountain confines; but eventually all the running waters are absorbed by the dry sands of the plains or evaporated into the drier air; and from the mouth of the Colorado to that of the Yaqui, five hundred miles away, no fresh water flows into the sea. During the winter season, and to a less

extent during that of summer, the mountain waterways are occupied by rushing torrents, rivaling great rivers in volume, and these floods flow far over the plains; but during the normal droughts the torrents shrink to streamlets purling among the rocks, or they give place to blistering sandwastes furlongs or even miles in width and dozens of miles in length, while beyond stretch low, radially scored alluvial fans, built by the great freshets of millenniums. Only a trifling part of the rainfall of the plains ever gathers in the waterways heading in the mountains, and only another small part gathers in local channels; the lighter rains from higher clouds are so far evaporated in the lower strata of air as to reach the earth in feeble sprinkles or not at all; the product of moderate showers is absorbed directly by earth and air; while the water of heavy rains accumulate in mud-burdened sheets spreading far over the plains, flowing sluggishly down the slopes, yet suffering absorption too rapidly by earth and air, to permit concentration in channels. These moving mud-blankets of the plains, or sheet-floods, are often supplemented by the discharge from the waterways of adjacent sierras and buttes; they are commonly miles and frequently dozens or scores of miles in width and the linear flow may range from a fraction of a mile to scores of miles according to the heaviness of the rainfall and the consequent dilution of the mud. Such sheet-floods, especially those produced by considerable rains, are characteristic agents of erosion throughout most of the province; their tendency is to aggrade depressions and corrode laterally, and thus to produce smooth plains of gentle slope interrupted only by exceptionally precipitous and rugged mountain remnants. A part of the sheet-flood waters join the stronger mountain-born streams, particularly toward the end of the great storm whereby earth and air are satur-

ated; another part forms ground-water, which slowly finds its way down the slopes toward the principal valleys, perhaps to reappear as springs or to supply wells. These, with certain other conditions determine the water supply available for habitation throughout Seriland. . . .

The flora of the Sonoran province affords a striking example of the adjustment of vegetal life to an unfavorable environment. The prevailing vegetation is perennial, of slow growth and stunted aspect; and it is not distributed uniformly but arranged in separate tufts or clusters, gathering into a nearly continuous mantle in wetter spots, though commonly dotting the plains sparsely, to completely disappear in the driest areas. Nearly all of the plants have roots of exceptional length, and are protected from evaporation by a glazed epidermis and from animal enemies by thorns or offensive odors and flavors; while most of the trees and shrubs are practically leafless except during the humid seasons. Grasses are not characteristic, and there is no sward, even in oases; but certain grasses grow in the shadow of arborescent tufts and in the fields of the farmer ants, or spring up in scattered blades over the moister portions of the surface. The arborescent vegetation represents two characteristic types, viz. (1) trees and shrubs allied to those of humid lands, but modified to fit arid conditions; and (2) distinctive forms, evidently born of desert conditions and not adapted to a humid habitat, this type comprising the cacti and related forms, as well as forms apparently intermediate between the cacti and normal arborescent type. The various plants of the district, including those of the distinctive types, are communal or commensal, both among themselves and with animals, to a remarkable degree; for the common strife against hard physical environment has forced them into coöperation for mutual sup-

port. The tufts or clusters in which the vegetation is arranged express the solidarity of life in the province; commonly each cluster is a vital colony, made up of plants of various genera and orders, and forming a home for animal life also of different genera and orders; and, although measurably inimical, these various organisms are so far interdependent that none could survive without the coöperation of the others.

In Seriland proper, as in other parts of the Sonoran province, a prevailing tree is the mesquite; on the alluvial fan of Rio Sonora, it grows in remarkable luxuriance, forming (with a few other trees) a practically continuous forest twenty to forty feet in height, the gnarled trunks sometimes reaching a diameter of two or three feet; over the Rio Bacuache fan and much of the remaining plain surface it forms the dominant tree in the scattered vital colonies; and here and there it pushes well into the canyon gorges. The roots of the mesquite are of great length, and are said to penetrate to water-bearing strata, at depths of fifty to seventy-five feet; its fruit consists of small hard beans imbedded in slender woody pods. Associated with the mesquite in most stations are the still more scraggy and thorny cat-claw and iron wood, both also yielding woody beans in limited quantity. Similarly associated, especially in the drier tracts, and characteristically abundant over the plains portions of Isla Tiburon, are the paloverdes, etc., forming scraggy, wide-branching, green-bark trees, five to fifteen feet in height and commonly three to ten inches in diameter of trunk. Over the mountain sides, grow sparsely the only straight-trunk trees of the region, rooted in the rocks to the average number of a few score to the square mile; this is the paloblanco. Associated with it along rocky barrancas of permanent water supply is a fig tree which has

the habit of springing from the walls and crests of cliffs, and sending white-bark roots down the cliff faces to the water fifty or one hundred feet below, and which yields a small, insipid, and woody fruit. Interspersed among the larger trees, and spreading over the intervening spaces, particularly in the drier and more saline spots, grow a number of thorny shrubs, much alike in external habits and appearance, though representing half a dozen distinct genera, while considerable tracts are sparsely occupied by straggling tufts of the Sonoran greasewood, or creosote bush, whose minute but bright green leafage relieves that prevailing gray of the landscape in which the lighter greens of the paloverde and cactus stems are lost. Intermingling with the woody trees and shrubs in most stations, and replacing them in some, are the conspicuous and characteristic cacti in a score of forms. . . .

On many of the higher plain-slopes, especially in eastern Seriland, there are pulpy-stemmed shrubs and bushes, sometimes reaching the dignity of trees, which present the normal aspect of exogenous perennials during life, but which are so spongy throughout as to shrink into shreds of bark-like debris shortly after death. . . . These plants grow in the scattered and scraggy tufts characteristic of arid districts, they are protected from evaporation by the usual glazed epidermis, and maintained by the water absorbed during the humid seasons; but they are thornless and are protected from animal enemies by pungent odors and at least in some cases by toxic juices. Like various plants of the province they are measurably communal — indeed one specie, the torotito, appears to be dependent upon union with an insect for reproduction, like certain yuccas, and like (to some degree at least) the cina and other cacti.

Along the lower reaches of the Rio Bacuache, and in

some of the deeper gorges of the Sierra-Seri and the Sierra Kunkaak, grow a few veritable trees of moderately straight trunk and grain and solid wood. . . . These trees fruit, some producing a berry of medicinal properties and others a nut edible when not quite ripe and forming a favorite rattle bead when dry. On the banks of such gorges the slender branched baraprieta grows up in the shelter of more vigorous shrubs, its branches yielding basketry material, while its fruit is a woody bean much like that of the cat-claw. In like stations there are occasional clumps of yerba mala, an exceptionally leafy bush growing in straight stems suitable for arrowshafts, and alleged to be poisonous from root to leaf—with inherent probability, since the plant is without the thorny armature normal to the desert. Along the sand-washes, especially about their extremities wet only in floods, springs a sub-annual plant, which shrinks to stunted tussocks after a year or more of drought, but flourishes in close-set fens after floods; though of acrid flavor and sage-like odor, it is eaten by herbivores in time of need, and it yields abundant seeds, consumed by birds, small animals, and men. About all of the permanent waters not invaded by white men and the white men's stock, there are brakes of cane or carizal; the jointed stems are half an inch to an inch in thickness and eight to twenty-five feet in height; the seeds are edible, while the stems form the material for balsas and afford shafts for arrows, harpoons, fire sticks, etc., and the silica-coated joints may be used for incising tough tissues.

The coasts of Seriland, both insular and mainland, are skirted by zones of exceptionally luxuriant shrubbery, maintained chiefly by fog moisture. Along the mountainous parts of the coast the zone is narrow and indefinite, but on the plains portions it extends inland for several miles with

gradually fading characters. Most of the fog-fed species are identical with those of the interior, though the shrubs are most luxuriant and are otherwise distinctive in habit. On the Tiburon side of gale-swept El Infernillo, and to some extent along other parts of the coast, some of these shrubs grow in dense hedge-like or mat-like masses, often yards in extent and permanently modeled by the wind in graceful dune-like shapes. Somewhat farther inland, the flatter coast-wise zones of Tiburon are rather thickly studded with shrubby clumps from six inches to two feet high, made up of many communals. While still farther inland follows the prevailing Sonoran flora of mesquite, scrubby paloverde and chaparral, etc., only a little more luxuriant than normal.

Throughout Seriland proper, and especially in the interior valleys of Tiburon, grasses are more prevalent than in other portions of the Sonoran province, their abundance being due to the rarity of graminiverous animals during recent centuries.

Considered collectively, the fauna of the Sonoran province is measurably distinctive (though less so than the flora), especially in the habits of the organisms. The prevailing animals, like the plants of extraneous type, evidently represent genera and species developed under more humid conditions and adjusted to the arid province through a long-continued and severe process of adaptation; and no fundamentally distinct orders or types comparable with the cacti and torotes of the vegetal realm are known. The prime requisite of the animal life in the province is ability to dispense with drinking, either habitually or for long intervals, and to maintain structure and function in the heated air despite the exceptionally small consumption of water; the second requisite is ability to coöperate in the marvelously complete soli-

curity of animal and vegetal life characteristics of sub-desert regions. No systematic studies have been made of special structures in the animal bodies adapting them to retention of liquids, either by storage, as in the stomach of the camel, or by diminished evaporation, though the prevalence of practically non-perspiring mammals, scale-covered reptiles, and chitin coated insects, suggests the selection, if not the development, of the fitter genera and species for the peculiar environment. Much more conspicuous are the characters connected with coöperation in the ever severe but never eliminative strife for existence in the sub-desert solidarity; the mammals are either exceptionally swift like the antelope, exceptionally strong like the local lion, exceptionally pugnacious and prolific like the peccary, or exceptionally capable of subsisting on waterless sierras like the bura and the mountain goat; the reptiles are either exceptionally swift like the rainbow-hued lizards, exceptionally armed like the sluggish horned toads, exceptionally poisonous like the rattlesnake, or exceptionally repulsive, if not poisonous, like the Gila monster; even the articulates avoid the mean, and are exceptionally swift, exceptionally protective in form and coloring, exceptionally venomous like the tarantula and scorpion and centipede, or exceptionally intelligent like the farmer ant and the tarantula hawk; while there is apparently a considerable class of insects completely dependent upon the coöperation of plants for the perpetuation of their kind, including the yucca, moth, and cactus beetle. Among plants the intense individuality (which is the obverse of the enforced solidarity) is expressed in thorns and heavily lacquered seeds and toxic principles; among animals it is expressed by chitinous armament, as well as by fleetness and fangs and deadly venom.

The larger land animals of Seriland proper are the moun-

tain goat in the higher sierras, the bura (or mule-deer) and the white tail deer on the mid-height plains and larger alluvial fans, with the antelope on the lower and drier expanses. Associated with these are the ubiquitous coyote, a puma, a jaguar of much local repute which roams the higher rocky sites, and a peccary ranging from the coast over the alluvial fans and mid-height plains of the mainland (though it is apparently absent from Tiburon). Of the smaller mammals the hare (or jack rabbit) and rabbit are most conspicuous, while a long-tail nocturnal squirrel abounds, its burrows and tunnels penetrating the plains of finer debris so abundantly as to render these plains impassable for horses and nearly so for men. The California quail and the small Sonoran dove are fairly common; a moderate number of small birds haunt the more humid belts, and there is a due proportion of Mexican eagles and hawks of two or three forms, with still more numerous vultures. Ants abound, dominating the insect world, while wasps and spiders, with various flies and midges, gather about the vital colonies of the drier plains and swarm in the moister belts. Horned toads and various lizards—bright-colored and swift, or earth-tinted and sluggish—are fairly abundant, while black-tail rattlesnakes haunt the more luxuriant vegetation of fog zones, permanent waters, and cienegas. On the whole, land fauna of Seriland is much like that of the province in general, though the various forms of life are less abundant than the average, since all (excepting the abounding squirrel) are sought for food by the omnivorous Seri; and the distribution, even when relatively abundant, is woefully sparse, as befits the scant and scattered vegetal foundation for the animal life.

Strongly contrasted with the meagerness of the land fauna is the redundant aquatic fauna of that portion of

the gulf washing the shores of Seriland. Tiburon island is named from the sharks, said by some explorers to have been seen by thousands along its coasts; these voracious feeders find ample food in literal shoals and swarms of smaller fishes; a not inconsiderable number of whales have survived the early fisheries (one estimated at eighty feet in length, was stranded in Rada Ballena about 1887); while schools of porpoises play about in different places, making easy prey of slower swimmers caught in the tide-rips and gale-swept breakers. Proportionately abundant and varied is the crustacean life; littoral mollusks cling to the ledges exposed among all the rocky coast stretches, and the entire beach from Punta Antigualla to Punta Ygnacio is banded by a practically continuous bank of wave-cast molluscan shells, the shell drift being often yards in width and many inches in depth. Common crabs abound in many of the coves and a large lobster-like crab frequently comes up from deeper bights and bottoms; oysters attach themselves to rocks and to the roots of shrubby trees skirting protected bays, while clams are very numerous in all broad mud flats, and the pearl oyster was fished for centuries until the ferocity of the Seri put an end to the industry. Especially abundant and large are the green turtles on which the Seri principally subsist, leaving the shells scattered along the shores and about rancherias in hundreds; while two land tortoises range about the margins of the lagoons, and one of these is alleged to enter the water freely.

The abundance of water fowl is commensurate with that of submarine life. The pelican leads the avifauna in prominence if not in actual numbers; gulls are always in sight, and the cormorant is common; while different ducks haunt several of the islets, and the shores are promenaded by curlews, snipes, and other waders. There is a corre-

sponding wealth of plankton, which at low spring tide with offshore gale covers acres of shallow littoral with squirming or inert but always slimy life, the substratum for that of higher order; and jellyfish and echinoids are cast up by nearly every wave, while at night the surf rolls up the smooth strands in shimmering lines of phosphorescent light. On the whole the aquatic life teems in tropic luxuriance and more than ordinary littoral variety; for the waters of the gulf are warmed by radiation and conduction from its sun-parched basin, while the concentrated tides distribute and stimulate the species and keep the vital streams astir. . . .

There is some doubt as to who was the first among the Caucasian explorers of the Western Hemisphere to set eyes upon the Seri Indians. Nuño de Guzman, rival of Cortez, must have approached the southern boundary of Seri territory about 1530, though there is no record of contact with these tribesmen. Diego Hurtado de Mendoza, one of Cortez' captains, coasted along the southern part of Sonora in 1532 where he was massacred on his return and hence left no record of more northerly natives. Both of these pioneers must be therefore eliminated from the list of probable discoverers of the Seri.

In the course of their marvelous transcontinental journey, Alvar Nuñez Cabeza de Vaca and his companions also approached Seriland, and apparently skirted its borders shortly before meeting Captain Diego de Alcarez, of Guzman's party; this was in April, 1536. Vaca wrote: "On the coast is no maize; the inhabitants eat the powder of rush and of straw, and fish that is caught in the sea from rafts, not having canoes. With grass and straw the women cover their nudity. They are a timid and dejected people." He added half a dozen ambiguous sen-

tences, of which only a part, apparently, refer to the "timid and dejected people;" half of these describe a poison used by them "so deadly that if the leaves be bruised and steeped in some neighboring water, the deer and other animals drinking it soon burst." The people were identified as Seri (Ceri) by Buckingham Smith and General Stone, and the identification may be considered as strongly probable, provided the Tepoka be classed with the Seri.

The next Caucasians to approach Seriland appear to have been the two Spanish monks, Fray Pedro Nadal and Fray Juan de la Asuncion; . . . but the meager account of their journey contains no clear reference to the Seri Indians. . . . Omitting others who probably explored some of the regions around about Seriland and left no definite record, mention must be made of Captain-General Francisco Vasquez Coronado, who set out on his ambitious and memorable expedition to the Seven Cities of Cibola. . . . Coronado's forces were divided, a considerable part of the army falling behind the leader; and some time during the summer, the belated army founded the town of San Hieronimo de los Corazones. From Corazones Don Rodrigo Maldonado went down to the seacoast to seek some ships that were expected and he brought back with him "an Indian so large and tall that the best man in the army reached only to his chest," with reports of still taller Indians along the coast. It is impossible to trace Maldonado's route with certainty, but in view of geographic and other conditions, it is evident that he must have descended Rio Sonora and approached or reached the coast over the broad delta-plain of that stream south of Seriland and thus within Seri territory. The reported gigantic stature practically identifies the Indians visited by him with the Seri, since no other gigantic tribes were consistently

reported by explorers of western North America, and since the six foot Seri warriors, with their frequent Sauls of greater stature, are in fact gigantic in comparison with the average Spanish soldiery of earlier centuries. There are indications that the fame of these giants of the southern sea spread to Europe and filtered slowly throughout the intellectual world, and that the fancy-colored colossi grew with their travels, after the manner of their kind — indeed there is no slender reason for opining that these half-mythical islanders were the real originals of Jonathan Swift's Brobdingnagians, despite his location of their fabled land a few leagues farther northward on the long mysterious coast below the elusive "Straits of Anian."

About the middle of September, 1540, Captain Melchior Diaz, then in command of part of Coronado's forces stationed at Corazones, selected twenty-five men from the forces remaining at that point, and set out for the coast on what must have been one of the most remarkable, as it is one of the least known, expeditions in the history of Spanish explorations; for he traversed either the streamless coast or the hardly more hospitable interior through one of the most utterly desert regions in North America, from the lower reaches of Rio Sonora to the mouth of the Colorado. . . . On the return journey, Diaz lost his life through an accident and his party reached Corazones on January 18, 1541, after encountering hostility from Indians not far from that settlement. Word was sent to Coronado, then in winter quarters on the Rio Grande, who despatched Don Pedro de Trovar to the settlement for the purpose of punishing the hostile natives; he, in turn, sent Diego de Alcaarez with a force to seize the "chiefs and lords of a village." This Alcaarez did, but soon liberated his prisoners for a petty exchange. Finding themselves free, they re-

newed the war and attacked them, and as they were strong and had poison, they killed several Spaniards and wounded others so that they died on the way back. . . They got back to the town, leaving seventeen dead from the poison. They would die in agony from only a small wound, their bodies breaking out with an insupportable pestilential stink.

The Coronado expedition had further experience with evidently the same Indians; for as the army approached Corazones on the return a soldier was wounded, and was successfully treated, according to the record, with the juice of the quince. The poison, however, had left its mark upon him. The skin rotted and fell off until it left the bones and sinews bare, with a horrible smell. The wound was in the wrist, and the poison had reached as far as the shoulder when he was cured. The skin on all this fell off.

There is some question as to the identity of the Indians met by Diaz's men, Alcarez and his force, and the Coronado forces near Corazones; but various indications point to the Seri. In the first place the several Indian settlements mentioned in the records define what must have been then, as it was two centuries later, the Seri frontier, beyond which lay the "despoblado" of Villa Señor, i. e., the immense area hunted and harried by roving bands from Tiburon; so that the Seri must frequently have crossed the paths pursued by the Spanish pioneers. In the second place, the accounts seem to be typical records of contact with Seri Indians. . .

The most conspicuous characteristic of the Seri tribe as a whole is isolation. The geographic position and physical features of their habitat favor, and indeed compel, isolation: their little principality is protected on one side by stormy seas and on the other by still more forbidding deserts; their home is too hard and poor to tempt conquest,

and their possessions too meager to invite spoliation; hence, under customary conditions, they never see neighbors save in chance encounters on their frontiers or in their own predatory forays — and in either case the encounters are commonly inimical. The natural isolation of the habitat is reflected in their modes of life and habits of thought; and during the ages the physical isolation has come to be reflected in a bitter and implacable hereditary enmity towards aliens — an enmity forming apparently the strongest motive in their life and thought, and, indeed, grown into a persistent instinct. Thus the Seri stand alone in every respect; they are isolated in habitat, and still more intensely isolated in habits of thought and life from all contemporaries; they far out-Ishmael the Ishmael of old on Araby's deserts. . . .

The population of the Seri so far as could be definitely ascertained was in 1894 about sixty or seventy warriors with about three or four times as many women and children, i. e., the population was apparently about two hundred and fifty to three hundred and fifty. There are indications to show that the tribe is very prolific and well-fitted to survive unless cut off in consequence of the hereditary antipathy against alien blood and culture.

Several physical characteristics of the Seri Indians are so conspicuous as to attract attention even at first sight. Perhaps the most striking is the noble stature and erect but easy carriage; next in prominence is the dark skin tint, the third is the breadth and depth of chest; another is the slenderness of limbs and disproportionately large size of extremities, especially the feet; still another is length and luxuriance of the hair; and an impressive characteristic is a peculiar movement in walking and running.

The mean stature of the Seri may be estimated at six

feet for the males and five feet eight or nine inches for the females. From pictures, unpublished photographs, and observations made on the ground, it is evident that all the fully adult males and several of the females overtop the Caucasian unit. . .

The Seri skin tint is of the usual Amerindian bronze, save that it is exceptionally dark, with a decided tone of black. . . Experienced observers of the native tribes may form an impression of the Seri color from the explanation that they are as much darker than the neighboring Papago as the Papago are darker than the average tribesmen about the Great Lakes; the Papago themselves being as much darker than the southern plains or Pueblo folk as these are darker than those of the Lake region. The range in color seems to be slight. . .

Foremost among the general somatic distinctions between the Caucasian and the American native is the peripheral development of the former, displayed in the better-muscled limbs, more expressive features, etc., i. e., the Caucasian body expresses a readily perceptible but difficultly describable peripherization, in contradistinction from the centralization displayed by the aboriginal body. Save in a single particular (the large hands and feet), the Seri exemplify this distinction in a remarkable degree. Their chests are strikingly broad, deep, and long, recalling the thoroughbred racer or greyhound; their waists are shortened by the chest development, yet are rather slender; their hips are broad and deep, with a clean-cut yet massive gluteal development, and, in comparison with the robust yet compact bodies, the tapering arms and legs seem incongruously slender. . . The Seri robustness of body and slenderness of limb are brought out by the absence (in appearance at least) of adipose; the skin is strikingly firm and hard and evidently

thick, yet the play of muscle and tendon beneath indicate a dearth of connective tissue and convey that impression of physical vigor which their familiars so miss in their photographs; and in no case, save perhaps in the young babe, could the slightest trace of obesity be found. Thus the Seri, male and female, young and old, may be described as notably deep-chested and clean-limbed quick-steppers, or as human thoroughbreds.

The somatic symmetry of the average Seri, marred somewhat by the slenderness of limb, is still more marred by the large extremities. The hand is broad and long, the fingers are relatively long as those of the Caucasian, the nails are peculiarly thick and strong, and the skin is so thick and calloused as to give a clumsy look to the whole organ; the feet are still larger and thicker-skinned, appearing disproportionate long and broad for even the heroic stature of the tallest warriors. The integument covering of the feet, ankles, and lower legs, is incredibly firm and hard, more resembling that of the horse or camel than the ordinary human type; its astounding protective efficiency being attested by the readiness with which the Seri run through cactus thickets so thorny as to stop horses and dogs, or over conglomerated spall-beds so sharp that even the light coyote leave their trail. In the absence of measurements, it may merely be noted that the hands and feet of the Seri are materially larger, not only absolutely but relatively to their stature, than those of neighboring tribesmen or even of Mexican and American workmen; and, on the whole, it may be said that in their proportions, as in their stature and color, the Seri are strikingly uniform, their range being less than that commonly observed in contemporary tribes, and the differences between them and their neighbors much exceeding the range among themselves.

Somatically distinctive as is the Seri at rest, he (or she) is much more so in motion — though the characteristics so readily caught by the eye are not easily analyzed or described. Perhaps the most conspicuous element in their walk is a peculiarly quick knee movement, bringing the foot upward and forward at the end of the stride; this emerges into an equally quick thrust of the foot forward and downward, with toe well advanced, toward the beginning of the next stride; and these motions combine to produce a singular erectness and steadiness of carriage, the body moving in a nearly direct line with a minimum of lateral swaying or vertical oscillation, while the legs neither drag nor swing, but spurn the ground in successive strokes. Thus the walk seems notably easy and graceful, while the walker carries the air of alertness and reserve power, as if able to stop short at any point of a pace, or to bolt forward or backward or sideways with equal facility; he simulates the "collected" animal whose feet tap the ground lightly and swiftly while his body appears to yield freely to voluntary impulse. In this deer-like or antelope-like movement all the Seri are much alike, and all are decidedly removed from their neighbors, even the light-footed Papago.

Among the conspicuous but non-distinctive somatic characteristics of the Seri is luxuriant straight hair, habitually worn long and loose. Commonly the hair is jet black for most of the length, growing tawny towards the tips. Age-grayness seems not to be characteristic; the most aged persons known have no more than a few inconspicuous and scattered gray hairs, though the pelage of some is slightly bleached or faded. . . . With few exceptions the hair is kept long as it can be made to grow and it receives careful attention to this end. In general it appears to increase in length and luxuriance not only throughout adolescence but

up to late maturity, for the best pelages are presented by the moderately aged people while none of the youths are so luxuriantly tressed as their elders. Not the slightest trace of baldness appears. . . . On the whole, it may be said that the Seri hair is luxuriant and vigorous beyond the aboriginal average, and that it, like various other somatic features, indicates a relatively late maturation in the life history of the individual. Both sexes are beardless. . . . The teeth are solid, close-set, and even, and impress the observer as large.

The most striking trait of the Seri is the pedestrian habit. The warriors and women and children alike are habitual rovers. . . . They are not a domiciliary folk, but rather homeless wanderers, customarily roving from place to place, frequently if not commonly sleeping where overtaken by exhaustion and storm, ordinarily slumbering through a part of the day and watching by night, habitually avoiding fresh waters save in hurried and stealthy visits, and apparently gathering in their flimsy huts only on special occasions. In conformity with their rovingness the Seri are notable burden bearers. They habitually carry their entire stock of personal belongings (arms, implements, utensils, and bedding), as well as their stock of food and — weightiest burden of all — the water requisite for prolonged sustenance amid scorching deserts, in all their wanderings, the water being borne chiefly by the women, in ollas, either balanced on their heads singly or slung in pairs on rude yokes like those of Chinese coolies; they have never grasped the idea of imposing their burdens on their bestial associates. . . .

A trait of the Seri hardly less conspicuous than their pedestrian habit, is habitual use of hands and teeth in lieu of the implements characteristic of even the lowly culture found even among the most primitive tribes. Perhaps the

most nearly universal implement is the knife — at first of shell, tooth, bone, or wood, later of stone and last of metal — and hardly a primitive tribe known from direct observation or from relics has been found independent of this serviceable weapon, yet the Seri may be described with reasonable accuracy as a knifeless folk. The dearth of tools and the absence not only of knives but of knife sense explain the alleged recourse of the Seri warriors to nature's weapons, used in the centripetal fashion characteristic of nascent intelligence.

The Seri are distinguished by another trait hardly less striking than their pedestrian habits and even more conspicuous than the tooth-and-nail habit and the correlative absence of tool-sense; the trait is not tangible enough for ready description or definition in terms, but is akin to, or, more properly, an exceedingly intensification of, race-pride in all its protean manifestations; it may be called *race sense*. Like other primitive folk, the Seri are self-centered in individual thought, i. e., they habitually think of the extraneous phenomena of their little universe with reference to self; furthermore, they typify primitive culture in their collective thinking, which is tribe-centered i. e., they view extraneous things, especially those of animate nature, with reference to the tribe, like all those lowly folk who denote themselves by the most dignified words in their vocabulary and designate aliens by opprobrious epithets; but the Seri outpass most, if not all, other tribes in dignifying themselves and derogating contemporary aliens. Concordantly with this habitual sentiment, they glory in their strength and swiftness, and are inordinately proud of their fine figures and excessively vain of their luxuriant locks — indeed they seem to exalt their own bodies and their own kind well toward, if not beyond, the verge of inchoate deification. The obverse of

the same sentiment appears in the hereditary hate and horror of aliens attested by their history, by their persistent blood-thirst, and by the rigorous marriage regulations adapted to the maintenance of tribal purity; for just as their highest virtue is shedding alien blood, so is their blackest crime the transmission of their own blood into alien channels. The potency of the sentiment is established by the unparalleled isolation of the tribe after centuries of contact with the Caucasians, by their irriducible love of native soil, by their implacable animosity towards invaders, and by their rigorously maintained purity of blood; it is manifested in their commonplace conduct by a singular combination of hauteur and servility, forbidding associations with aliens on terms of equality. . . Every human being is panoplied in a personality, perhaps intangible but none the less real, which repels undue approach and fixes limits to familiarity on the part of strangers, friends, kinsmen, and mates, according to their respective degrees of mutually elective affinity; but the Seri are so close to each other and so far from all others that they are collectively panoplied against extra-tribal personalities even as are antipathetic animals against each other — and the Seri can no more control the involuntary snarl and growl at the approach of the alien than can the hunting-dog at sight or smell of the timber wolf.

While the highly developed traits represented by pedestrian habit, hand-and-tooth habit and segregative habit expressing race-sense are conspicuous during exercise, each carries an equally well-marked obverse. Thus, while the Seri are known as runners par excellence in a region of runners, and were named by aboriginal neighbors from their spryness of movement, they have been no less notorious among Caucasian neighbors of two generations for

unparalleled laziness — for a lethargic sloth beyond that of the sluggish ox and somnolent swine, which was an irritating marvel to the patient padres of the eighteenth century, and it is even today a by-word in the even-tempered Land of Mañana; concordantly the sinewy hands and muscular jaws are noticeably inert during the intervals of intense functionings, are particularly free from the spontaneous or nervous movements of habitually busy persons, and contribute by their immobility to the air of indolence or languor which so impressed padres and rancheros. . . . The observer is impressed by the long intervals between the periods of activity; true, the intense activity may cover hours, as in the chase of the deer, or days, as in a distant predatory raid, or perhaps even weeks, when the tribe is on the warpath; yet all the known facts indicate that far the greater portion of time of warriors, women, and children is spent in idle lounging about in rancherias and camps, in lolling and slumbering in the sun by day, and in huddling under the scanty shelter of jacales or shrubbery by night — i. e., when their activity is measured by hours, their intervals of repose must be measured by days.

On reviewing the more conspicuous somatic functions and structures jointly, they are found to throw some light on their own development, and hence on the natural history of the Seri tribe.

Certain characteristics of the Seri strongly suggest lowly condition, i. e., a condition approaching that of lower animals, especially of the carnivorous type; among these are the specific color, the centripetally developed body, the tardy adolescence, the defective tool-sense, the distinctive food habits (especially the consumption of raw offal and carrion), the independence of fixed habitations, and the extreme alternations between the rage of chase and war

and the quiescence of sluggish repose. But these primitive characteristics are opposed or qualified by such features as the noble stature, the capacious and shapely brain-case, the well-developed hands, and the considerable intelligence revealed in the native shrewdness as well as in organization and belief. Collectively the characteristics are in some measure incongruous; yet all are at least fairly compatible with the inference that the tribe is exceptionally (if not incomparably) low in the scale of general human development, yet at the same time highly specialized along certain lines; and the inference in turn is corroborated by the coincidence between the special lines of development and the peculiar conditions of environment characterizing the habitat of the tribe.

Striking correspondence between Seri physique and Seri habitat is revealed in the pedal development, with the attendant development of muscle and bone, lung capacity and heart power, together with other faculties involved in the pedestrian habit. Seriland is a hard and inhospitable home; sea-food is indeed abundant and easily taken but water is terribly — often fatally — scarce, and obtainable only by distant journeyings from the places of easy food supply; moreover, the monotony of the diet is alleviable only by extensive wandering for the collection of vegetal products or severe chase after land animals; while the war-like spirit, inherited apparently from a less humane ancestry and fostered by geographic isolation, combines to keep the tribe afoot, avoiding waters, conducting raids, and moving constantly from place to place in the endless search for safety. There is a widespread Sonoran tradition that the Seri systematically exterminate weaklings and oldsters; and it is beyond doubt that the tradition has a partial foundation in the elimination of the weak and

helpless, through the literal race for life, in which the bands participate on occasion. A parallel eliminative process is common among American aborigines; the wandering bands frequently undergo hard marches under the leadership of athletic warriors with whom all are expected to keep pace, and this leads both to the desertion of the weak and aged and to increased strength and endurance on the part of the strong and enduring; yet it would appear that this merciless mechanism for improving the fit and eliminating the unfit attains unusual, if not unequaled, perfection among the Seri. Now pedal development is one of the special processes of peripheral (or centrifugal) functioning and growth, involved in the general process of *cheirization*, which, coördinately with cephalization, defines human progress;⁵ and this developmental process explains the specialization of the Seri along one or more lines, and connects the special development directly with environing conditions.

A notable correspondence between structure and function, of such character as to reflect the habit and habitat, appears in the conspicuous manual development of the Seri. Enjoying a climate too mild to make houses necessary, finding animal food too plentiful to necessitate elaborate contrivances for the chase and milling or other devices for reducing vegetal food, provided by nature with material (in the form of carrizal) for an ideally suitable water craft, barred by geographic boundaries from neighboring tribes, and having neither material for nor interest in commerce, the denizens of Seriland were never forced into the way of mechanical development; yet their simple industries, involving as they do swift stroke and strong grasp and dexterous digitation, are mainly such as urge manual de-

⁵ "The Trend of Human Progress," *American Anthropologist*.

velopment more strenuously than would be normal among tribesmen connected with their environment through the medium of tools. The demand for manual strength and skill among the Seri is intensified by both natural and domestic conditions; the ever ready (and almost sole) material suitable for simple adjuncts to the hand abounds in the wave-worn cobble form; these cobbles are easily usable in such wise as to serve all ordinary purposes, and their abundance discourages the production of more highly differentiated tools; while their habitual use promotes manual strength and deftness, coupled with that digital freedom (required, for example, in grasping a ball) which most clearly distinguishes the human hand from the subhuman paw. Conjoined with these natural conditions are domestic demands tending to cultivate manual fitness and to eliminate the manually unfit; for, in addition to the direct industrial premium on dexterity, through which the dexterous survive while the clumsy starve, there is a special premium growing out of marriage custom through which only the manually efficient (and at the same time morally acceptable) are put in the way of leaving lines of descendants. . . . Accordingly, the robust-bodied and slender-limbed yet big-fisted and big-footed Seri seem to be adjusted, so far as their more striking somatic characters are concerned, to distinctive habits themselves reflecting distinctive habitat; and the coincidences appear to reveal and establish the law of interaction between the human organism and its environment — an interaction effected through the habits and hence through the normal functioning of the individual organisms as constrained through their collective relations. And recognition of the law of interaction opens the way to consideration of other correspondences between structures and functions and enviroing conditions.

Conspicuous among the more strictly functional traits of the Seri is the intensity of action characteristic especially of warriors, though in a less degree of the whole tribe — an intensity made all the more striking by contrast with the extreme inertness between stresses. Manifestly the capacity for concentrated effort is in harmony with the tribal habits, themselves reflecting habitat. The resource of prime importance in Seriland — that which directly and constantly conditions the very existence of human inhabitants — is potable water. The prime source of life is too heavy to be transported and too unstable to be stored with the facilities of primitive culture, yet it is always within reach of an organism strong enough to journey ten, twenty or fifty miles in search of it, and acute enough to follow trails and indications. Naturally the meager water-supply serves as a mechanism for sorting out and preserving the strong and acute, and for eliminating the weakly and dull; hence the tribe have developed a faculty or perhaps a potentiality of a distinctive sort — the potentiality of providing against thirst-death by a reserve power in the organism itself rather than in the form of mechanical devices such as characterize higher culture. Quite similar are the relations to the resource of the second importance, that is, ordinary food. Habituated to dispensing with storage and transportation of their primary resource, and accustomed to finding food whenever forced to sufficiently active effort to obtain it, the Seri have never grasped that first principle of thrift expressed in the accumulation of food supplies; accordingly they intuitively rely on successful fishing or chase or search of vegetal edibles for sustenance, and habitually delay effort until they are stirred into activity by the pangs of hunger. Naturally this improvidence serves as another mechanism for perpetuating families of stored vital-

ity; . . . the effect of this mechanism too; is to develop a reserve power in the organism itself, in lieu of the material reserve made through thrift in higher culture. Similar in their consequences are the relations of the individual organisms to the third industry of Seriland, that is the navigation of the gale-swept and tide-troubled waters. Even the buoyant balsa can not weather the williwaws or ride the tide-rips of El Infiernillo without exercise of the most strength and skill on the part of the navigators; while the often persistent storms may delay for days embarkation on voyages in quest of fresh water and food. Naturally, the frequent delays and not infrequent perils of such navigation constitute a mechanism for selecting navigators possessed of reserve powers adequate to meet desperate emergencies with vigor and judgment even after enervating waits for wind and tide, while those not so well endowed are either brought up to standard in their hard training-school or expelled from their class by drowning or dashing on the rocks, as may happen; so that the effect of this mechanism is to preserve individuals and perpetuate generations characterized by reserve power, and hence to develop latent potentiality in the tribe. . . .

Summarily, the Seri are characterized by noble physique, by peculiarly lightsome and swift movements, by great endurance coupled with a capacity for vigorous action, by animal-like symmetry and slowness of maturation, and by various minor attributes combining with the major features to form a distinct race-type; and they are still more conspicuously characterized by an acute race-sense, which holds them apart from all aliens. At first sight, several of their somatic attributes seem incomparably primitive, yet analysis of the attributes in the light of certain laws which they exemplify better than other peoples thus far studied, in-

dicates not so much a lack of development as an excess of growth along somatic lines with a correlative defect of development along demotic lines, and when the lines of growth are traced to their sources and conditions, it becomes fairly clear that the aberrant development of the tribe is merely the reflection of a distinctive environment operating evidently throughout a long period. In brief, the somatic interest of the Seri seems to center in the remarkable adjustment of the tribe to environment—an adjustment of so much delicacy as to imply interaction throughout many generations. . . .

One of the conspicuous customs of the Seri is painting the face in designs by means of mineral pigment. About half the tribe are painted. On noting the individual distribution of face-painting, it is found to be practically confined to the females, though male infants are sometimes marked with devices pertaining to their mothers, as adult warriors are said to be on special occasions; and so far as observed all females, from aged matrons to the babe in arms, are painted, though sometimes the designs are too nearly obliterated by wear to be traceable. . . . The painted designs vary among individuals but are fairly persistent for each. The face-painting seems to be essentially symbolic of zoic tutelaries and to signify subspecific characteristics maintained by the clan organization and kept prominent by the militant habit of the tribe; at the same time it is noteworthy that the purely symbolic motive is accompanied by a nascent decorative tendency, displayed by the individual refinement of form and color in the symbol proper to each of the groups.

Aside from face painting there is a conspicuous dearth of decoration or tangible symbolism among the Seri. The symbolic or decorative modification of the physique would

seem to be limited to two classes of mutilations, of which one class was observed at Costa Rica in 1894 while the other is apparently obsolete. The observed corporeal modification is the absence of medial superior incisors of the females, in consequence of forcible removal at a period not definitely ascertained. . . It is probable that the custom is connected with marriage. Whatever the period of infliction Mashem's guarded expressions seem to indicate that it was probably a mark of physical inferiority; this suggestion interpreted in the light of the Seri use of teeth as weapons of offense and defense, would seem to indicate that the mutilation is at once the badge of corporeal inferiority and a means of maintaining the physical superiority of the males. . . The second mutilation was the only corporeal modification noted by the early missionaries and explorers—it was the perforation of the nasal septum for the insertion of a skewer, perhaps of polished stone, though doubtless more commonly of bone, to which swinging objects were attached. One of the most useful records is that of the Jesuit, Padre Joseph Och, who described the nasal attachment as a small, colored stone suspended by cords from the perforatic septum, and guarded with such jealous veneration that "one must give them at least a horse or cow for one." Except these two mutilations the corporeal decoration of the Seri is apparently limited to face-painting. . .

The most conspicuous single article in their dietary is the local green turtle. This chelonian is remarkably abundant throughout the Gulf of California. . . Its flesh yields food; some of its bones yield implements; its carapace yields a house-covering, a convenient substitute for umbrella or dog-tent, a temporary buckler, and an emergency tray or cistern, as well as a comfortable cradle at the beginning of life and the conventional coffin at the end; while

the only native foot-gear known is a sandal made from the integument of a turtle flipper.

Doubtless the eggs and the newly hatched young of the turtle are eaten and analogy with other peoples indicates that the females are sometimes captured at the laying time on the grounds or on their way back to water; but observation is limited to taking the adult animal at sea by means of specialized harpoons. . . . The blood, entrails and all the soft parts are at once devoured, and the firmer flesh follows at a rate depending upon the antecedent hunger, both men and women crushing integument, bone and tendon with the hupf, tearing other tissues with nails and teeth, mouthing shreds from the shells, and gorging the whole ravenously if well ahungered, but stopping to singe or smoke or even half-roast the larger pieces if nearer satiety. If the quarry is too large for immediate consumption and they are not too far from a rancheria the remnants, including head and flippers and shells, are hoisted to the top of the jacal immediately over the open end — the conventional Seri larder — to soften in the sun for hours or days; and on these tough and gamey tidbits, the home-stayers, especially the youths, chew luxuriously, whenever other occupations fail. In times of plenty such sun-ripened fragments of reeking feasts are rather generously appropriated, first to the children and afterwards to the coyote dogs; and it is a favorite pastime for the toddlers to gather about the inverted carapace, on hands and knees, crowding their heads into its noisome depths, displacing the rare scavenger beetles and blowflies of this arid province, mumbling at the cartilaginous processes, and sucking and swallowing again and again the tendinous strings from the muscular attachments, until overcome by fullness and rank effluvia, they fall asleep with their heads in the trough to be stealthily nudged aside by the cringing curs attached to the rancheria. . . .

It is probable that the water fowl, considered collectively, stand second in importance as Seri prey; and the foremost fowl is undoubtedly the pelican, which serves not only as a fruitful food supply but as the chief source of apparel. The principal haunt and the only known breeding ground of the pelican in the Gulf of California is Isla Tissue, an integral part of Seriland. . . . At certain seasons, pelican harvests are planned; and after some days of preparation, a large party assemble at some convenient place and await a still evening in the dark of the moon. When all conditions are favorable they set out for the island at late twilight, in order that it may be reached after dark; on reaching the shore the balsas are left in charge of the women, while the warriors and the larger boys, armed only with clubs, rush on the roosting fowls and slaughter them in large numbers — the favorite blow being on the back of the neck. The butchery is followed by a gluttonous feast, in which the half-famished families gorge the tenderer parts in the darkness and noisily carouse in the carnage until overcome by slumber. Next day the women select the carcasses of least injured plumage and carefully remove the skins, the requisite incisions being made either with the edge of a shell cup or with a sharp sliver of cane stalk taken from an injured arrow or a broken balsa-cane. The feast holds for several days, until the last bones are picked and the whole party sated, when the clans scatter at will, laden with the skins and lethargic from the fortnight's food with which each maw is crammed. . . . Probably next in importance in Seri prey, as a food source merely, stand the multifarious fishes with which the waters of Seriland teem, particularly if the class be held to comprise the cetaceous and seals and selachians ranked as leaders of the fish fauna in Seri lore.

Naturally, whales lie outside the range of Seri game, yet

they are not without place in the tribal economy. During the visit to the Seri rancheria near Costa Rica in 1894, it was noted that various events — births, deaths, journeys, etc. — are referred to as the "Time of the Big Fish"; and it was estimated from the apparent ages of children and the like that this chronologic datum might be correlated roughly with the year 1887. . . . On visiting Isla Tiburon in 1895, the interpretation became clear; along the western shore of Rada Bellena, near the first sand spit north of the bight, lay the larger bones of a whale, estimated from the length of the mandibles and the dimensions of the vertebræ to have been about seventy-five or eighty feet long. It is evident the animal had gone into the shoal water at exceptionally high tide and stranded during the ebb, while the condition of the bones suggested an exposure to the weather of perhaps half a dozen years. On the shrubby bank above the beach, hard by the bleaching skeleton, stood the new rancheria, the most extensive seen in Seriland, having some fifteen or twenty habitable jacales; and fragments of ribs and other huge bones about and within the huts attested transportation thither after the building, while the shallowness of the trails and the limited trampling of the fog shrubbery gave an air of freshness to the site and surroundings. The traditions and the relics together make it manifest the "Time of the Big Fish" had indeed marked an epoch in Seri life; that when the leviathan landed (whether through accident or partly through efforts of balsa men) it was quickly recognized as a vast contribution to the Seri larder; and that some of the clans, if not the entire tribe, gathered to gorge first flesh and blubber, next sun-softened cartilage and chitin, and epiphyses and then the fatter bones.

Traces of the bones of the seal too were found in a few

places indicating that this also furnished food to the simple folk, and closely connected with the fish as a Seri food source are the various molluscan and crustacean forms, collectively called shell fish; and these contribute a considerable share of the food supply to the tribe. Among the first in importance may be mentioned the Pacific Coast clam, then the oyster. . . . On the whole, shell fish form a conspicuous factor in Seri economy by reason of the considerable consumption of this class of food; but viewed in the broader industrial aspect, the produce is notably primitive and significant chiefly as indicating the dearth of mechanical and culinary devices.

While by far the larger share of Seri maintenance is drawn from the sea, a not inconsiderable portion is derived from the land, for the warriors and striplings and even the women are more skilful hunters than fishers. . . . The products of the chase are largely the deer, the hare, hawk, and other birds.

A quantitatively unimportant but by no means negligible fraction of the normal diet of the Seri is vegetal; and while the sources of vegetal food are many and diverse, the chief constituent is a single product characteristic of American deserts, namely the tuna or prickly pear. All the cacti of this region yield tunas in considerable quantity. . . . The edible tunas average about the size of a lemon, and they resemble figs save that their skin is beset with prickles. The portion eaten is a luscious pulp, filled with minute seeds, like those of the fig, save that they are too hard for mastication or digestion, its flavor ranging from sickening sweet of the overcultivated fig to a pleasant acidity. While occasionally tunas may be found at any time during the year, the normal harvest occurs about midsummer, or shortly before the July-August humid season and lasts for sev-

eral weeks. During the height of the season the clans withdraw from the coast and give undivided attention to the collection and consumption of the fruits, gorging them in such quantities that, according to the testimony of the vaqueros, they are fattened beyond recognition.

Perhaps the second in importance among the vegetal constituents of Seri diet is the mesquite bean, which is gathered at random whenever a well-loaded tree is found and other conditions favor. The woody beam and still woodier pods are pounded with the hupf on any convenient stone until roughly pulverized; if there are no stones at hand, they are carried in baskets or improvised bags to the nearest shore or other place at which stones may be found. The half ground grist is winnowed in the ordinary way of tossing in a basket; and the grinding and winnowing continue alternately until a fairly uniform bean meal is obtained. So far as actually observed this is eaten raw, either dry in small pinches, or more commonly, stirred in water to form a thin atole; but expressions at Costa Rica indicated that the meal is sometimes stirred in boiling water or pot liquor, and thus partially cooked, in times of rest and plenty. . . .

At first sight Seriland seems an abnormal habitat for a primitive people, since its land area is cleft in twain by a stormy strait — a strait whose terrors to the few Caucasian navigators who have reached its swirling currents are indicated by their appellations, "El Canal Peligroso de San Miguel" and "El Infiernillo," for such a stretch of troubled water is commonly a more serious bar to travel than any moderate land expanse. This intuitive notion of the effectiveness of a water-barrier, and the correlative feeling of the incongruity of a land barrier insuperable for centuries, is well illustrated by a prevailing opinion throughout north-western Mexico; for it is commonly supposed in Sonora

and neighboring states that Seriland is conterminous with Isla Tiburon, that is, that the mainland portion of the province lies beyond the diabolic channel. Yet longer scrutiny shows that the superficial impression merely mirrors Caucasian thought and fails to touch essential conditions, especially as they are reflected in the primitive minds of the local tribe; and careful study of the habits and history of the Seri shows that the dangerous strait has been a potent factor in preserving tribal existence and perpetuating tribal integrity. Naturally the factor operates through navigation; for it is by this means that the tribesmen are able to repel or avoid the rare invaders of either mainland or insular portions of their province, the overland pioneers from the east being stopped by the strait and the maritime explorers from south and west being unable to maintain themselves long about the stormy shores and never outfitted for pushing far toward the mainland retreats and strongholds; while by means of their light and simple craft the Seri were able to retreat or advance across the strait as readily as over adjacent lands to which they were wonted by the experience of generations. In their minds, indeed, El Infiernillo is the nucleus of their province. So the Seri were among the lowliest learners of that lesson of highest statecraft, that lands are not divided but united by intervening sea; and their ill-formulated and provincial notions are of much significance in their bearing on primitive habits and habitats.

The water-craft of which the Seri make so good use is the balsa, made of three bundles of cane lashed together alongside, measuring barely four feet abeam, one and one-half feet in depth, and some thirty feet in length over all. . . . The manufacture of the balsa has never been seen by Caucasian eyes, but the processes are safely inferred from the

structure. The first step is the gathering of the cane from one of the patches growing about the three or four permanent fresh waters of Seriland, the canes being carefully selected for straightness, symmetry, and uniformity in size; these are then denuded of leaves and tassels, tied in bundles of convenient size, and carried to the shore. . . . In actual construction the canes are laid butt to butt, but overlapping two or three feet, the overlap being then shifted this way and that with successive additions, so that the aggregate length of overlapping in the bundle reaches ten or twelve feet, that is, the full length of the body of the finished craft. The growing bundle is wrapped from time to time with lashings of mesquite root or maguey fibre, and kept in cylindrical form by constant rolling and by means of lashing; though the cord used for the purpose is so slender as to do little more than serve the purposes of manufacture. . . . As the bundle approaches the requisite size, the building process changes; the butts of the successively added stalks are thrust obliquely into the interstices extending beyond the butts of earlier-used canes and the stems are slightly bent to bring them into parallelism with their fellows; and this interweaving process is continued with increasing care until, when the bundle is completed, there are no visible butts (all being pushed into the interior of the bundle), while the only visible tips are those projecting to form the tapering extremities. The finished bundle is then secured by a spiral winding of a slender cord. Two other bundles are then made, the three being entirely similar, so far as is known; then the three are joined by a lashing of the slender cord like that used for separate bundles. . . . The cordage is either of mesquite root or maguey fibre, the former being the more common (doubtless by reason of the dearth of the latter plant); it is notably uniform in twist

and size, though surprisingly slender for the purpose, barely three-sixteenths of an inch in diameter, and limited in quantity. The only tools or implement used in the manufacture (and repair), so far as known, are light wooden marlinspikes; these are used in working the cane-butts into bundles. In collecting the canes the tassels are broken off and the leaves stripped by the unaided hands, while the stalks are broken off usually below the secondary roots in the downward taper, and the rootlets and loose ends are removed either with the hands or by fire. The finished balsa is notably light and buoyant. It weighs about two hundred and fifty pounds when thoroughly dry. . . . It can easily be picked up by three or four or even by two strong men and carried ashore to be hidden in the fog shrubbery skirting the coast. The craft floated high with one man aboard, rode better with two, carried three without much difficulty even in a fairly heavy sea, and would safely bear four adults aggregating six hundred pounds in moderate water. The most striking features of the craft are its graceful movements and its perfect adaptation to variable seas and loads. Carrying twice its weight of (usually) living freight, it breasts gales and rides breakers and stems tide-rips that would crush a canoe, swamp a skiff, or capsize a yawl; while if caught in currents or surf and cast ashore it is seldom wrecked, but drops lightly on beach or rocks, to be pushed uninjured by the broken wave-tips beyond the reach of pounding rollers, even if it is not at once caught up by its passengers and carried to complete safety. The strength of the craft is amazing, especially in view of the slenderness of the cords used in construction. . . .

Among the Seri, as among primitive folk generally, the habitation reflects local conditions, especially climate and building materials. Now, Seriland is a subtropical yet arid

tract, where rain seldom falls, frost seldom forms, and snow is known only as a fleeting mantle on generally distant mountains, so that there is little need for protection from cold and wet; at the same time the district is too desert to yield serviceable building material other than rock, which the lowly folk have not learned to manipulate. Moreover, the tribesmen and their families are habitual and perpetual fugitives, their movements being too erratic and aimless to put them in class of nomads; they are too accustomed to wandering and too unaccustomed to long resting at particular spots to have a home sense, save for their motherland as a whole; and, just as they rely upon their own physical hardihood for preservation against the elements, so they depend upon their combined fleetness and prowess for preservation against their enemies. Accordingly the Seri habitation is not a permanent abode, still less a domicile for weaklings or a shrine for household lares and penates, not at all a castle of proprietary sancity, and least of all a home; it is rather a time-serving lair than a house in ordinary meaning.

Despite the poverty of material and squalor of the structure, certain features of the Seri jacal are notably uniform and conventional. In size and form it recalls the passing "prairie schooner," or covered wagon; it is ten or twelve feet long, half as wide measured on the ground, and about four and one-half feet high, with one end — the front — open to the full width and height, and the other nearly or quite closed. The conventional structural features comprise the upright bows and horizontal tie-sticks forming the framework. The bows are made of okatilla stems roughly denuded of their thorns; each is formed by thrusting the butts of two such stems, or more if they are slender, into the ground at the requisite distance apart, bend-

ing the tops together into an overlap of a yard or two, and securing them partly by intertwisting, partly by any convenient lashing; and about five or six such bows suffice for a jacal. Next come the tie-sticks, which consist of any convenient material, canestalks, mesquite roots, etc., and they are lashed to the butts by means of withes, splints, or fiber wisps, at a height of four feet above ground, or about where the walls merge into the roof. With the placing of these sticks the conventional part of the building process may be said to end; for up to this point the process is a collective one and the materials are essentially uniform, while thereafter the completion of the work depends largely upon individual or family caprice, and the materials are selected at random. Moreover, the frame work is fairly permanent, usually surviving a number of occupancies extending over months and years, and outlasting an equal number of outer coverings; so that all Seriland is dotted sparsely with jacal skeletons, sometimes retaining fragments of walls or roofs but oftener entirely denuded, and the conversion of the framework into a habitable jacal is effected by piling round and over it any convenient shrubbery, by which it is made a sort of a bower. . . . The Seri building chant is suggestive. It is not regarded as religious or even as ritualistic but merely as a work-song, designed to make the task lighter. This seems to be the local interpretation and if it is correct, the simple chant at once offers rational explanation for its own existence, and opens the way to explanation of the more elaborate building rituals of the more advanced tribes. The work-song is a common device in many lowly activities, ranging from those of children at play to those of sailors at the windlass, and doubtless serves a useful purpose in guiding, coördinating, and concentrating effort.

Slightly as they have been affected by three centuries of sporadic contact with higher culture, the Seri reveal many marks of acculturation; and the most conspicuous of these are connected with clothing, especially on the frontier, where women and warriors habitually wear a livery of subserviency in the form of cast-off Caucasian rags. Even in the depths of Seriland the native fabrics are largely replaced by white men's stuffs, obtained by barter, beggary, or robbery; yet it is easy to distinguish the harlequin veneer of borrowed trappings from the few fixed types of covering that seem characteristic.

The most distinctive piece of apparel is the kilt, extending from waist to knees, worn alike by men, women, and the larger children. Aboriginally it was either a birdskin robe, or a rectangle of coarse textile fabric secured at the waist by a hair-cord belt. . . . The kilt serves other purposes at the convenience of the wearer; in the chase for tunas and for moving game it becomes a bag or pack sheet; in case of cold rain it is shifted to the shoulders or exposed side; during the siesta it is elevated on a shrub and stick to serve as a canopy; at sleeping time generally it forms a bed, that is, a combined coverlet and mattress; and in attack or defense the pelican skin is at once standard, buckler, and waving capa to confuse the enemy.

An almost equally distinctive garment is a short shirt or wammus, with long sleeves, worn by women and men, but not by children. Unlike the kilt, it is an actual garment fitted with sleeves, and fastened in front with hair-cord strings. It is undoubtedly of aboriginal local design and was made of hair cloth or textile fabrics, and worn rather ceremoniously; but latterly it is worn habitually at least by the women and on the frontier, and cast aside in preparation for any special work or task. These two articles con-

stitute the ordinary wearing apparel of the Seri. No covering is worn on the head save in the ceremonial masquerade, when the heads of animals are worn as masks. . . .

There is only one conspicuous toilet article; this is a hair-brush made from yucca fiber bound into a cylindrical form. This article is in frequent use; both men and women give much attention to brushing their own long, luxuriant locks and cultivating the hair and scalps of their children, the process being regarded as not only directly useful but in some measure sacramental. Ordinarily, the hair is parted in the middle and brushed straight, the tresses being permitted to wander at will and never braided or bound or restrained by fillets save in imitation of Caucasian custom on the frontier; though in certain ceremonies the pelage is gathered in a lofty knot on the top-head.

The Seri cradle is merely a bow of pablancó or other switch with rude cross-sticks lashed on. On this is laid a small pelican-skin robe and a quantity of pelican down for a diaper, and perhaps a few pelican plumes to wave over the baby's face; though on the frontier these primitive devices are largely replaced by rags.

In advanced culture tools are finished products, made and used in accordance with preconceived designs or established arts for the production of commodities; in primal life, as well exemplified by Seri handicraft, tools are mere by-products incidental to the largely instinctive activities directed toward the maintenance of life. Accordingly the tools of advanced culture form the nucleus of industries, while the designless tools of the prime cluster about the outskirts of industrial activities, that is, in developed industries the tool is a primary factor, while in nascent industries it is but collateral. . . .

Perhaps the most conspicuous general fact in connection

with Seri tools and their uses is the prevalence of natural objects employed (1) either in ways suggested by natural functions or (2) in ways determined by the convenience of users; the former grading into artificial devices, shaped in similitude of natural objects and employed in ways suggested by natural functions.

Prominent among the natural objects employed in natural ways are mandibles of birds, used in piercing pelts and fabrics; fish spines and bones also used as piercers; thorns of cacti and mimosas, used in similar ways; teeth and horns of game animals, used in rending their own tissues, and afterwards in miscellaneous industrial processes; together with cane splints, used for incising. . . . With these objects may be grouped the turtle-shells and pelican-pelts, used as shields against alien and animal enemies, or as protectors against the elements; and the Seri sages would class with these the deer-head masks and deer-hoof rattles worn in the dance to symbolize and invoke strength and swiftness. One of the most striking among the artificial devices of symbolic motive is the piercer or awl of wood or bone shaped in imitation of the avian mandible; yet still more significant in a vestigial way is the hard wood foreshaft of arrow and harpoon, shaped and used in trenchant symbolism of the deadly tooth.

There are two conspicuous classes of natural objects employed in ways determined largely by the convenience of the users, namely, marine shells and beach pebbles. The marine shells are used ordinarily as drinking cups, dishes, dippers, receptacles for fats and face-paints, and as small utensils generally; and they are used nearly as commonly for scraping skins, severing animal and plant tissues, digging graves and water-holes, propelling balsas, and especially for scraping seeds and sticks in the manufacture of arrows, harpoons,

bows, balsas and jacal frames. Indeed the sea shell is the Seri's familiar and ever present handmate and helper. . . .

Next to the shells, the most abundant industrial appliances of the Seri are beach pebbles or cobbles. They are used for crushing shell or bone, for rending the skin of larger animals, for severing tendons and splintering bones, as well as for grinding or crushing seeds, uprooting canes, chopping trees and branches, driving stakes, and other minor purposes connected with the manufacture of arrows and balsas and jacals; they are also the favorite woman's weapons in warfare and the chase. . . . The cobble-stone implements of the Seri range from pebbles to bowlders and there is a corresponding range in function from light hand implements at one end of the series to the unwieldy anvils and metates at the other. The intermediate sizes are not generally utilized. . . .

Something is known of Seri warfare through the history of the centuries since 1540, and especially through the bloody episodes of the Encinas régime during the occasional outbreaks of the last decade or two. As befits their primitive character, warfare has played an important rôle in the history of the folk, forming, indeed, one of the chief factors in determining the course of tribal development. There is no means of estimating the losses suffered and occasioned in warfare with neighboring tribes during historic or prehistoric times; but the indications are they were much greater than the losses connected with Caucasian contact. Neither is it practicable to estimate reliably the fatalities attending the interminable conflicts with the Spanish invaders and their descendants, though it is safe to say the losses of the Seri against Spanish and Mexicans aggregate many hundreds and that the correlative loss on the part of the enemies reaches several score, if not some hundred,

lives. Few if any other aboriginal tribes of America have had so sanguinary a history as the Seri, and none other has at once so long and so bloody a record.

According to consistent accounts of several survivors of conflict with the Seri, their chief weapons are arrows, stones, and clubs — though several survivors manifest more fear of the throttling hands and rending teeth of the savage warriors than of all their artificial weapons combined. A striking feature of their recitals, indeed, is the rarity of reference as to weapons; the ambushes or surrounds or chance meetings, with their disastrous or happy consequences, are commonly described with considerable detail; . . . the ordinary expressions concerning the despised but dreaded Seri are precisely those employed in recounting conflicts with carnivorous beasts; . . . all indicate that while the Seri are famous fighters, their weapons — except their “poisoned” arrows which were much dreaded, are incidents rather than essentials to savage assaults, and their prowess rests primarily on bodily strength and swiftness.

The stones used in battle are cobbles as large as the fist, that is, hupfs of typical size and form. So far as known they are never hurled, slung, or projected in any other manner, nor are they hafted or attached to cords after widespread aboriginal customs; they are merely held in the hand, as in the slaughter of the turtle, etc. . . The most conspicuous and doubtless the most effective weapon is the arrow, a large part of which is pointless save for the hardwood foreshafts.

The most notorious feature of their warfare and that of deepest interest to students, is the reputed use of poisoned arrows. The scattered literature of the Seri abounds in references to this custom; the Jesuit authorities gave varied

yet fairly consistent descriptions of the preparation and the effect of these arrows. . . .

The war-frenzy of the Seri fighters is in parallelism with the blood-craze of the chase, and even more so in its analogy with the warpath customs and ceremonies of most Amarind tribes and many other primitive peoples. In typical tribes the warpath custom is a most distinctive one, standing for an abnormal state of mind and an unaccustomed habit of body, perhaps to the extent of an extreme exultation or obsession akin to intoxication, in which the ordinary ideas of justice and humanity are inhibited; among most tribes the condition is sought voluntarily and deliberately when occasion is thought to demand, and is superinduced by fasts and vigils, exciting songs and ceremonies, and related means; while among certain tribes the aid of symbolic "medicines," which may be actual intoxicants, is invoked. Thus the savage on the warpath is a different being from the same man in time of peace; viewed from his own standpoint, he is possessed of an alien and violent demon, usually that of a fantastic and furious beast-god whose rage he must symbolize and enact; viewed from the standpoint of higher culture, he is a raving and ruthless maniac whose craze is none the less complete by reason of its voluntary origin. . . . The Seri blood-craze expresses a most profound and bitter enmity towards aliens — more so than is found among most savage tribes — that is, it is instinctive and persistent in exceptional degree; it is more spontaneous and explosive in its culmination when conditions favor than among tribesmen who induce the conditions by elaborate preparation. Their war customs, like several other customs of the tribe, seem to afford a connecting link between the habits normal to carnivorous beasts and the well-organized customs of somewhat higher culture-grades; and

thus they contribute to outlining the course of human development through some of its darker stages. They are exceedingly poor in devices for defense, having no earthworks, barricades, fortifications, palisades, or other protective structures. . . . The actually effective protection of the Seri in warfare is their fleetness, coupled with their habitual and constitutional timidity, that is, their wildness. Moreover, they are adepts in concealing their persons and movements behind shrubbery and rocks and in finding cover on the barest plains; and suggestions are not wanting that the protecting shrub-clumps and rocks of their wonted ranges are credited with occult powers and elevated to the lower places of their zoic pantheon, after the customary way of that overpowering zootheism, or animism, which the Seri so well exemplify in many of their habits. . . .

The most noticeable social fact revealed about the Seri rancherías is the prominence of females, especially the elder women, in the management of everyday affairs. The matrons erect the jacals without help from men or boys; they carry the meager belongings of the family and dispose them about the habitation in conformity with general custom and immediate convenience; and after the household is prepared, the men approach and range themselves about, apparently in a definite order, the matron's oldest brother coming first, the younger brothers next, and finally the husband who squats in, or outside of, the open end bower. The house and its contents belong exclusively to the matron, though her brothers are entitled to places in it whenever they wish, while the husband has neither title nor fixed place, "because he belongs to another house" — though as a matter of fact he is frequently at or in the hut of his spouse, where he normally occupies the outermost place in the group and acts as a sort of outer-guard or sentinel.

Conformably to their proprietary position, the matrons have chief, if not sole, voice in removing the rancherías; and such questions as that of the placement of a new jacal are discussed animatedly among them and finally decided by the dictum of the eldest in the group. . . . The initial jacal is frequently erected by a solitary female and sometimes by two or three aged dames; around this nucleus other matrons and their children gather in the course of a day or two; while it is usually three or four days, and sometimes a week, before the brothers and husband skulk singly or in small bands into the new ranchería.

It should be observed the identification of kindred by the alien observer is difficult and somewhat uncertain, since the relationships recognized in Seri socialry are not equivalent to those customary among Caucasians. It is found especially difficult to recognize the husband of the jacal, partly because he is commonly incongruously younger (and hence relatively smaller) than his mistress, and partly because of the undignified position as outer-guard into which he is forced by tribal etiquette. Moreover, his connection with the house is veiled by the absence of authority over both children and domestic affairs, though he exercises such authority freely (within customary limits) in the jacals of his female relatives. There is, in fact, some question as to the clear recognition of paternity; certainly the females have no term for "my father"; that is, the term is the same as that for "my mother," *em*, though the males distinguish the maternal ancestor by a suffixed syllable (*e* = "my father"; *éta* or *itah* = "my mother") which seems to be a magnificative or an intensificative element. It is noteworthy that the kinship terminology is strikingly meager. . . .

While the burden of the more permanent property pertains to the women, there is a decided differentiation of

labor with a concomitant vesting of certain property in the warriors—the distinctively masculine chattels comprising arrows, quivers, bows, harpoon, etc. There are indications that the balsas are regarded as masculine property. The impermanent possessions—water, food, etc.—seem to be the common property of men, women, and children, except so far as the right is regulated by regimentation; for the privileges of eating and drinking are enjoyed in the order of seniority. In the reckoning of seniority the chief ranks first, and the other warriors follow in an order affected in an undetermined way by conjugal relations as well as by their prowess and sagacity (the equivalents of age in primitive philosophy) down to an undetermined point, apparently fixed by puberty; then comes the clan-mother, followed by her daughters in the order of nominal age, which is affected by the status of spouses and the numbers of living offspring; finally come the children, practically in the order of their strength, though the girls—especially those approaching puberty—receive some advantage through the connivance of the matrons. . . . Every member of the clan is entitled to necessary food and raiment and it is the duty of every other member to see to it that the need is supplied.

The division of labor which affects proprietary interests is undoubtedly affected in turn by the militant habit of the tribe and by the frequent decimation of the warriors. In general, the adult males limit their work to fighting and fishing, with occasional excursions into the hunting field; though by far the greater part of their time is spent in listless lounging or heedless slumber, under the incidental guard of roaming youths and toiling matrons. The women are the real workers in the tribal hive; they are nominally alert and active, passing from one simple task to another,

gathering food along the beach or preparing edibles under the shadow of the jacal, with an eye ever upon material possessions and children; they frequently join in hunting excursions of considerable extent; they are the chief manufacturers of wearing apparel, utensils and tools; the scions of Castilian caballeros are not infrequently staggered at the sight of half a dozen Seri women "milling" a band of horses and at intervals leaping upon one to kill it. The masculine drones are more petted and courted by reason of their fewness, for during a century or two, at least, the women have far outnumbered their consorts — a disproportion, doubtless, tending in some respects towards the disintegration of the clan system and, reciprocally, toward the firmer union of the tribe.

One of the most noteworthy functions of women is shamanism. They concoct the arrow "poison," compound both necromantic medicines and curative simples, cast spells on men and things, and even fabricate the stone arrow-points, and counterfeit cartridges. They exercise formal legislative and judicial functions; for not only do they hold their own councils for the arrangement of domestic business of their rancherias, but they also participate prominently in the tribal councils, and play important rôles in carrying out the decisions of such councils — as when they coöperate with war parties as decoys, or journey across their bounding desert to spy out the land of the enemy. . . .

The most striking and significant social facts discovered among the Seri relate to marriage customs. As noted repeatedly elsewhere, the tribal population is preponderantly feminine, so that polygyny naturally prevails; the number of wives reaches three or possibly four, averaging about two, though the younger warriors commonly have but one, and there are always a number of spouseless dames, but no

single men of marriageable age. So far as could be ascertained, no special formalities attend the taking of supernumerary wives, who are usually widowed sisters of the first spouse; it seems to be practically a family affair governed by considerations of convenience rather than established regulations—an irregularity combining with other facts to suggest that polygyny is incidental, and perhaps of comparatively recent origin.

The primary mating of the Seri is attended by observances so elaborate as to show that marriage is one of the profoundest sacraments of the tribe, penetrating the innermost recesses of tribal thought, and interwoven with the essential fibers of tribal existence. Few if any other people devote such anxious care to their mating as do the Seri; and among no other known tribe or folk, is the moral aspect of conjugal union so rigorously guarded by collective action and individual devotion.

The initial movement toward formal marriage seems to be somewhat indefinite, or perhaps, rather spontaneous. It may be made either by the prospective groom or else by the father, though not directly by the maiden or her kinswomen. In any event the prerequisites of the union are provisionally determined in the suitor's family; these relate to the suitability as to age, the propriety of the clan relation, etc.; for no stripling may seriously contemplate matrimony until he has entered manhood, nor can he mate in his own totem, though all other clans of the tribe are apparently open to him; while the maiden must have passed (apparently by a considerable time) her puberty feast. The proposal is formally conveyed by the elderwoman of the suitor's family to the maiden's clanmother, when it is duly pondered, first by this dame, and her daughter matrons; and later if the proposal is entertained, it is deliberated

upon and discussed at length by the matrons of the two clans involved who commonly hold repeated councils for the purpose. At an undetermined stage and to an undetermined degree the maiden herself is consulted; certainly she holds the power of veto, ostensible if not actual. Pending the deliberations the maiden receives special consideration and enjoys various dignities; if circumstances favor, her kinswomen build a jacal for her; and even if circumstances are adverse, she is outfitted with a pelican robe of six or eight pelts and other matronly requisites. When all parties are eventually satisfied a probationary marriage is arranged, and the groom leaves his clan and attaches himself to that of the bride. Two essential conditions — one of material character and the other of moral — are involved in this probationary union. In the first place, the groom must become the provider for, and protector of, the entire family of the bride, including the dependent children and such cripples and invalids as may be tolerated by the tribe; that is, he must display skill and exercise it in turtle fishing, strength in the chase, subtlety in warfare and all other physical qualities of competent manhood. This relation, with the attendant obligations, holds for a year, that is, a round of the seasons. During the same period the groom shares the jacal and sleeping robe provided for the prospective bride by her kinswomen, not as a privileged spouse, but merely as a protecting companion; and throughout the probationary term he is obliged to maintain complete continence — i. e., he must display the most indubitable proofs of moral force. During this period the always dignified position occupied by the daughter of the family culminates; she is the observed of all observers, the subject of gossip among the matrons and warriors alike, the recipient of frequent tokens from designing sisters with an eye to share the spoils of her

spouse and the receiver of material supplies measuring the competence of the would-be husband; and through his energy she is enabled to dispense largess with a lavish hand, and thus to dignify her clan and honor her spouse in the most effective way known to primitive life; and at the same time she enjoys the immeasurable moral stimulus of realizing that she is the arbiter of the fate of a man who becomes warrior or outcast at her bidding and through him of the future of two clans, that is, she is raised to a responsibility in both personal and tribal affairs; which, albeit temporary, is hardly lower than that of the warrior-chief. In tribal theory the moral test measures the character of the man; in very fact, it at the same time, both measures and makes the character of the woman. . . . At the close of the year the probation ends with a feast provided by the probationer, who thereupon enters the bride's jacal as a personal guest of unlimited personal privileges, subject to tribal custom, while the bride passes from a half wanton heyday into the duller routine of matronly existence. . . .

The prevailing opinion among the better informed Caucasian neighbors of the Seri is that the tribesmen display an inhuman indifference to their dead; and this opinion is one of the factors — combining with current notions of cannibalism and arrow poisoning and beastlike tooting in warfare — involved in the widespread feeling that the tribesmen are to be accounted as mongrel and uncanny monsters rather than human beings. The opinion that they neglect their dead on occasion would seem to rest on a considerable body of evidence. The record of numberless neglected corpses of warriors polluting the air and poisoning the streams in 1757 would seem to be unusual only in its fullness. Some recognize better qualities among the people but declare they utterly neglect the bodies unless they die near

the rancherías, when they throw heaps of brambles upon them to bar the prowling coyotes; others again say they lie where they fall no matter where that may be. Then there stands the conspicuous fact, that well-marked cemeteries adjoin some of the rancherías of interior Seriland but this is unknown to the frontiersman. Another discrepant statement is that mourning ceremonies are important only among women. It is certain that the mortuary ceremonies attain their highest development among females. . . .

The special dignification of females in respect to funerary rites is without precise parallel among other American aborigines, so far as is known, but is not without analogies in the shape of vestiges of a former magnification of matrons in the mortuary customs of certain tribes. These vestiges are clear among the Iroquois Indians, whose aboriginal socialry coincided with that of the Seri at various points. . . .

The identifiable cemeteries of Seriland are small — much less populous than might have been expected of a tribe numbering several hundreds for centuries, and able to maintain well worn trails, threading all parts of the rugged domain. A scant half dozen graves are perceptible in one place, five or six in another, and the largest known cemetery has perhaps a score of evidently ancient graves. When near the pebbly beaches, the graves are marked by heaps of pebbles and small cobbles. These cairns are about three or four feet long, two-thirds as wide, but seldom over twelve or fifteen inches high. The graves remote from pebbly beaches are marked by heaps of cholla stems and branches, rudely thatched with brambles roughly pinned together by okatilla stems, the shocks being sometimes nearly as high and broad as the jacals. . . .

On the death of a matron, a grave is scooped out by means of shells, a few yards from her jacal, preference be-

ing given to relatively elevated or commanding points. The excavation is about thirty inches in depth. Within it is placed first the pelican-skin robe of the deceased, so arranged as to be folded over her body; then the corpse, dressed in the ordinary costume of life is compressed into small compass by closely flexing the knees and bringing them against the thorax, extending the arms around and along the lower limbs, so that the hands and feet are together, and bending the head forward on the chest; when it is deposited in the receptacle in such manner as to lie on the left side, facing northward. Near the face is laid a dish of baked clay or a large shell filled with food, and beside it a small olla or cup of water and the hairbrush, olla ring, and other domestic paraphernalia are placed near the hands; next the personal fetishes and votive symbols in the form of puppets or dolls are placed beneath the face of the dead mother and her paint cup, with a plentiful supply of paints, is added; the poor personal possessions, in the form of shell beads and other trumpery, are heaped over her head and shoulders, and these are covered with superfluous garments and miscellaneous property of the deceased. Finally the pelican-skin robe is folded over the body and two turtle shells are laid over all as a kind of coffin, when the grave is carefully filled and so smoothed as to leave no mark of the burial. During subsequent hours the stones for the cairns and the brambles for the brush heap are piled over the spot. . .

Soon after the death (immediately after the burial as nearly as could be ascertained) there is an apparently ceremonial mourning in which the matrons of the clan, and to some extent the warriors also, participate. The mourners wail loudly, throw ashes or ordure on their heads, and beat and bruise their breasts, faces, and arms, being careful however to avoid scarifying. This is continued, culminat-

ing daily about the hour of interment, for several days — unless the rancheria is sooner abandoned, in which case the period of formal mourning is shortened.

In addition to the formal meeting of matrons there is a custom of nocturnal wailing after the death of warriors in battle. . . . The first note of lamentation may be sounded at any hour of the night by any of the group to which the deceased belonged; it is successively taken up by other members of the party until all voices are united in a resounding chorus of inarticulate moans, wails, shriller cries, and wild howls, likened by the auditors to the blood-bellowing of cattle; if other groups of tribesmen are within hearing they, too, take up the cry, so that the lamentation may extend to the entire tribe and echo practically throughout all Seriland at the same moment. The fierce howling and attendant excitement may rise so high in the group in which the wailing begins, that all seem bereft of customary caution; and sometimes they suddenly seize ollas and weapons, and decamp incontinently, perhaps scattering widely and racing for miles before settling again for sleep or watchful guard. . . .

They have a belief of a life beyond the grave. So far as can be ascertained the belief seems to be that the dead find their way back to the primordial underworld whence Earth and Beings were brought up by Pelican and Turtle respectively and are liable to return by night with mischievous intent.

THE WORLD'S SUPPLY OF FUEL ⁶

Animal existence depends upon the utilization of potential energy stored up in the two forms of food and fuel.

⁶ Reprint from *The Forum*, 1889.

The first of these sources is utilized by all animals alike, but man has risen above his ancestral kindred and has made conquest of nature through the use of fuel. Man may indeed be defined as the fuel using animal. In common with him, the ant and wasp build habitations well adapted to their wants; the mouse, the squirrel, and the bee store up provisions against the inclement season, the immature butterfly spins a delicate strand, albeit from its own substance; the oriole weaves a strong, smooth fabric to protect its young; the tailor-bird prepares thread and sews seams; the ant enslaves kindred races that it may be relieved of labor, keeps kine for their milk, and is supposed to plant and cultivate, and is known to harvest; the beaver cuts canals and dams rivers; the monkey bridges the stream with its own body that its young may pass safely over; the spider lays snares; the ant-lion sets traps for game; certain monkeys use missiles in battle; the gorilla arms himself with a rude weapon; many animals effect organization for offensive and defensive purposes, and the laws of organization are enforced and obeyed; and in all other respects, the habits, industries, and institutions of the other animals graduate into those of man, save that he alone utilizes fuel in securing comfort, preparing food, and overcoming obstacles to progress, and by the means of illuminants, turns night into day, and thus lengthens life. Next to food, fuel is the most important topic of thought today, as in the days of the discovery and worship of fire.

In the history of the subjugation of natural forces for human weal, there is no more interesting episode than that of the utilization of the gaseous and liquid carbon compounds as fuels and illuminants. Wood and various woody plants have been used as fuel, and animal fats and vegetal oils as

illuminants, from time immemorial, and there is scarcely a savage tribe to which they are unknown. The advance from the burning of wood and charcoal to the burning of mineral coals was an easy one, and was probably made gradually and independently in many centers during historic and prehistoric time. The last step in the utilization of potential energy stored up in mineral substances was far longer, and was made within our memory; and, in consequence of the ready communication in recent years between distant lands, was taken in many parts of the world at the same time. It is true that natural gas-vents were known to and were for ages venerated by the fire worshipers whose cult they inspired; it is also true that springs of mineral oil have been known from history's dawn and that the oil was utilized sometimes as a fuel or an illuminant, though more commonly as a medicine or lubricant; and it is equally true that natural oils and tars were extracted by primitive means and used for primitive purposes by barbarous oriental peoples long before their fame spread to the Occident; but it has been only within a few years that these natural products have been utilized so extensively as materially to modify the course of human progress. Yet so rapidly have the applications of those compounds spread, that today most of our homes are lighted and many of our engines driven, and most of the bearings of our machinery and other innumerable mechanical contrivances lubricated by petroleum; while within the last lustrum the manufacture of such widely-used substances as glass and iron has been largely improved, and at the same time reduced in cost, by the use of rock gas. Still, the utilization of this and allied products is only in its infancy. Within our memory philosophic thought has been revolutionized by scientific conception — the doctrine of evolution; and it would appear that

we are now in the midst of an equally important industrial revolution growing out of the recognition of the unstable carbon compounds, as fuels and illuminants.

Pari passu with the industrial development accompanying the utilization of rock gas, geologic science made an unparalleled stride within a few months. Hunt, Newberry, and others have made important contributions to our knowledge, concerning the constitution and origin of petroleum and its allies, and the exploitation of the Pennsylvania and New York fields have afforded valuable additional data relating to these minerals. Nearly four years ago, Prof. I. C. White deduced from theory — now recognized as a fundamental law in gas prognostication — that gas, oil, and brine are accumulated in the order of their weight within inverted basins and troughs formed by flexures of the rocky strata. The importance of these contributions to our knowledge of the lighter bitumens must not be underestimated; yet when exploitation for gas began in Ohio, in 1886, the geologist literally sat at the feet of the prospector, gathering such crumbs as fell from his hands, and found himself utterly unable either to guide efforts or to predict results. Less than two years later the laws governing the distribution and accumulation of gas and oil were so fully developed that the rock-gas problem found a solution as satisfactory as that of the well-known artesian water problem, and today the geologist predicts the success or failure of a prospect bore for gas or oil about as readily and reliably as he can prognosticate artesian water or coal. Greater advance was probably never before made in so limited a time in any economically important branch of knowledge. The solution of the rock-gas and petroleum problem marks an era in science no less than in industry. Vast sums of money, possibly millions, were spent by prospectors in gathering data. . .

The conquest of light hydrocarbons ranks among the most exciting episodes of mining exploitation. When the oil fever broke out in Pennsylvania, wells were put down without adequate preparation, and the oil poured forth in such volume as to burst the barriers erected against it and overflowed by the thousand barrels, tainting the air, befouling the land, and poisoning the waters. In the fields of Pennsylvania, Ohio, and Indiana the pressure of rock gas was sufficient to blow out drills nearly a ton in weight, and to burst the double-riveted tanks and heavy iron mains in which it was sought to confine it; and the belief that its force was uncontrollable was at one time prevalent. In scores of cases the roar of the gases escaping could be heard for miles, and compelled the closing of schools and the stoppage of business in the vicinity of the well. When the gas was ignited by accident or design, the roar was augmented, and workmen were sometimes permanently deafened; while by night the surrounding country was illuminated, the light from a single well being visible over a radius of ten, twenty-five, and even forty miles. The cause of the enormous pressure under which the gas and oil were confined were not at first understood, and the latter substance was regarded as mysterious and uncanny, if not diabolic. The various ills to which flesh is heir were attributed to it, its utilization was deprecated as impious, and the belief that its extraction was the cause of earthquakes prevailed widely. . . .

Where? Why? Whence? Whither? These are the principal questions suggested in any intelligent community by the discovery of gas and oil, and propounded by thousands of laymen; and since the closing months of 1888 the geologist has been able to answer them definitely and in most respects, satisfactorily.

The rock gas now so generally recognized as "natural gas" in the northern states and Canada, has long been known technically as light carburetted hydrogen. In composition it closely resembles the inflammable marsh gas frequently seen bubbling from the muddy bottoms of stagnant pools or sluggish streams; indeed, marsh gas is the principal constituent of the rock gas of commerce and the arts. Marsh gas itself is a simple compound of carbon and hydrogen, in the proportion of seventy-five per cent of the former to twenty-five per cent of the latter. It is one of a large number of compounds of carbon, running through petroleum, asphaltum, coal, jet, graphite or plumbago, and ending with the diamond.

One of the compounds which may be distinguished as the coal series, comprises in order carbonized and lignitized woods, brown coal, bituminous coal, cannel coal, anthracite coal, graphite coal, jet, and some graphites. . . . The processes by which these compounds were transformed from the original to the present state in nature has been imitated in the laboratory, and it has been ascertained that the essential conditions are that the decompositions shall be effected slowly and under some pressure, and that the free evolution of the ordinary gases of dissolution shall be prevented and their constituents largely retained perhaps in new combinations. So the compounds of this series present not only the original processes of aggregation by which the organic matter was accumulated, but later processes of integration or evolution by which decomposition was effected with little loss of matter.

Another series of the compounds comprises such as are commonly classified as hydrocarbons, whether simple oxygenated, or compound; namely, marsh gas, the different varieties of rock gas, naphtha, petroleum, maltha or natural

tar, asphaltum, and other mineral waxes and resins, albertite and its allies, together with certain hydrogenated and approximately pure carbons, including some pure graphites and probably the diamond. While the origin of some of these minerals is doubtful and the exact relations among all obscure, enough is known to justify the opinion that the various compounds belonging to this series represent processes of evolution and segregation of carbonaceous matter (perhaps accumulated elsewhere) within geologic deposits. . . .

Study of the recorded geographic and geologic distribution of the bitumens shows that they occur in greater or less quantity, and in various forms, in nearly every country, and that they are found in nearly every geologic group of rocks. The greater part of commercially valuable bitumens are, however, concentrated in three widely-separated parts of the geologic column; namely: in the Tertiary in great volume and nearly all the known forms; in the upper Devonian as petroleum and gas, the former probably predominating; in the lower Silurian, as gas and associated petroleum. . . .

Every richly productive gas field, at least in the eastern states and Canada, is a dome or inverted trough formed by flexure of the rocky strata; and in every such dome or inverted trough there is porous stratum (sandstone in Pennsylvania and coarsely-grained magnesium limestone in Ohio and Indiana) overlain by impervious shales. These domes or arches vary in dimensions from a few square miles in the Pennsylvania areas, to 2,600 square miles in the great Indiana field. Within each gas-charged dome is found three or more substances arranged in the order of their weight: gas at the top, naphtha, if it exists in the field, and petroleum below, and finally water, which is generally salt,

and sometimes a strong and peculiar bittern. This order is invariable throughout each field, whatever its area, though in Indiana, at least, the oils are found most abundantly about the springing of the arch, while towards its crown gas immediately overlies brine; and the absolute altitude of the summit level of each substance is generally uniform whatever the depth beneath the surface.

In all productive bitumen fields, the gas and oil are confined under greater or less pressure. When a gas well is closed, it is commonly found that the pressure at the well head gradually increases, through a period varying from a few seconds in the largest wells to several minutes or hours in wells of feeble flow; and that afterward the pressure gauge becomes stationary. This is the "confined pressure," "closed pressure," or "rock pressure" of the prospector. . . . When a well is open and gas escapes freely into the air, it is found that if the stem of a mercurial or steam-gauge is introduced, a certain constant pressure is produced and indicated. This is the "open pressure" or "flow pressure" of the gas expert, and the capacity of the well may be determined from it. This pressure varies. In Indiana it ranges from 300 to 350 pounds per square inch, and in Pennsylvania it reaches from 500 to 900 pounds. The cause of the pressure is due to size of dome. The Cincinnati Arch (in which the gas of the great Indiana field is accumulated) is substantially a dome about fifty miles across, rising in the center of a stratigraphic basin fully 500 miles in average diameter. Throughout this immense basin, the waters falling on the surface are in part absorbed into the rocks and conveyed towards the center, where a strong artesian flow of water would obtain were the difference in altitude greater. . . . Gas pressure and oil pressure may be estimated in any given case as readily and reliably as artesian water pressure.

Rock gas is one of the family of bitumens, all of which are unquestionably of common or at least related origin. There are two theories to explain their origin. They are very properly designated organic and inorganic theories. The experience of technology, the results of experiments, the geologic and geographic distributions of the several bitumens, and observations upon the well known phenomena of marsh gas, all indicate that rock gas and its allies are simple results of the decomposition of organic matter contained in the rocky strata of the earth, and that their evolution is now in progress, in all rocks containing partially-decomposed animal remains, at the rate depending upon the amount of matter yet undecomposed, and upon the depth of the burial, or in general terms upon geologic age. This inference coincides with the first generalization deduced from geologic distribution.

The other theory is that which ascribes the hydrocarbons to reactions among inorganic substances in deep lying strata of the earth. This theory is widely accepted in Europe; but it is not in harmony with the phenomena of American gas, oil, asphaltum fields, and is not held by any American geologist or chemist of note, and requires no further consideration. The latest competent American opinion concerning the origin of the bitumens may be summed up in the following propositions: (1) that rock gas, petroleum, and the heavier members of the bitumen series are simple products of natural processes of decomposition of the organic matter contained in their sediments; (2) that their weight and other attributes depend upon the conditions under which decomposition takes place.

The exploiter and consumer of rock gas daily inquires, with a degree of anxiety, "Is the natural gas yet forming?" The affirmative answer may be given and it is pre-

dicted that gas will continue to form until the organic matter disseminated throughout the formations of the world, is completely decomposed, though the rate will ever decrease, and the proportion of oil to gas generated as the ages go on will constantly but slowly increase. But this affirmative answer and prediction can scarcely be regarded as encouraging to the prospector of today. . .

The use of rock gas has forced upon practical fuel consumers a conviction long held by students, namely, that the gaseous is the most convenient and economical form of fuel as well as illuminant. Even if the supply of rock gas were exhausted tomorrow, manufacturers of glass, certain grades of iron, and other products would substitute an artificial gas for the natural product rather than return to coal. Enormous waste would thereby be prevented, the gas by which the air in all coke-burning countries is contaminated would be utilized, and the carbon of the dense smoke-clouds by which manufacturing cities are overclouded would be turned to good account. Moreover, it is an easy step from the manufacture of coal gas to the distilization of bituminous shales abounding in carbon available only in gaseous form. Even if it had no other use, rock-gas is a boon to industry, in that it has led to the modification of manufacturing methods and the reconstruction of manufacturing plants in such a manner as to secure better and more economical results from other coal sources, in that it leads to the utilization of waste products, and in that it opens the way to the use of fuels not hitherto available.

At the present rate of consumption (1888) the known anthracite of America will be exhausted within a few decades, the known bituminous coal fields of the Carboniferous within a few centuries, and the vast bituminous coal beds of the Cretaceous in the Rocky Mountain region within

a millennium or two; and since the rate of consumption is ever increasing, the entire available stock of fixed carbons in this and other explored countries must melt away in a few centuries. Some coal fields in this and other countries unquestionably remain to be discovered; magnificent possibilities lie within the little-explored areas of South America, Africa, and Asia; but the surface and sediments of the earth have been examined so thoroughly as to prove that the final exhaustion of coals cannot be far off. To the geologist, who regards each coal-forming period as an epoch, the immeasurably shorter period of coal consumption is but a fleeting episode in the history of the earth — an episode so brief as to require multiplication by millions in order to be made commensurable with the terms of geochrony. With the growth of population and the ever-increasing control of natural forces by human intelligence, food sources multiply, while the sources of mineral fuel remain unrenewed; and were there no other fuel source than the fixed carbons of the coal seams, and lignite beds, the prospect for the future would be gloomy indeed. But while the stock of fixed carbons is so limited that its exhaustion is becoming a serious menace, the stock of bitumens in the rocks of the earth is practically unlimited. It is true that gas and oil are but sparsely disseminated through the strata; it is true that under existing commercial conditions they can be successfully exploited only where accumulated in exceptional volume; but despite the extravagant waste of gas accompanying the processes, oil was economically extracted before the great natural reservoirs were discovered, and with the increasing values following exhaustion of these reservoirs, the limits to improvement in methods of extraction and to material extractable are indefinitely remote. The rocks are as inexhaustible a source of hydrocarbons as

the soil is of carbohydrates, and under suitable stimuli, bountiful nature will probably give forth the one as lavishly as the other.

Rock gas and the related bitumens are the fuels and luminants of the future; upon them, in conjunction with the foods extracted from the soil and waters, we must depend for the energy by which the wheels of future progress will be kept in motion.

DESERT THIRST AS DISEASE ⁷

. . . In viewing thirst as a pathological condition, it is needful to review the rôle of water in normal physiology. The average human body is about one-fifth solid matter and four-fifths liquid, i. e., H_2O , or water. This liquid forms the chief distributing or circulating agency of the organism; it is no less essential to assimilation and metabolism than to circulation in the artero-venous and lymphatic systems; it forms the bulk of the softer tissues, and enters into the composition of the harder, and permeates or flows through all structures either by osmosis or through specialized vessels. As an agency connecting the individual with the external, i. e., with environment, water is far more important than "food," more important even than air; water streams through the entire organism, entering chiefly through the alimentary system and escaping through the skin and membranes as well as through the main secretory channels; water as liquid and vapor in connection with the lungs and skin affords the chief means of equalizing and controlling the temperature required for organic existence; and water is undoubtedly the primary requisite for that ironization

⁷ Reprint from *Interstate Medical Journal*, vol. xiii, St. Louis, 1906.

to which it is customary of late to reduce the chemistry of vital existence and growth. It is in harmony with the essential and distinctive rôle of water in the normal organism that the average human dietary embraces 4 to 12 parts of liquid to one part of solid matter — a mean ration for adults, say, of six pounds of liquid and one pound of dry food; it is in harmony, too, with the demonstrations of Dr. Tanner and others that with water a fast of forty days is feasible but without liquid is fatal in one-sixth of that time; indeed, water is to be regarded not so much a mere solvent of food-matter as an actual aliment — and by far the most important aliment in animal economy. Accordingly, in this view of the rôle of water in the normal body, thirst, in extreme stages at least, is seen to constitute and express a general and fundamental derangement of the vital system.

It may be convenient to define three types of thirst, i. e., (1) the Ordinary Thirst, experienced in humid lands, caves, mines, etc., in which the air is charged with aqueous vapor and the tissues little affected by salts external to the system; (2) the Thirst of the Sea, experienced where the air is heavily charged with vapor and non-potable liquid abounds, while the tissues are subjected to the action of salts; and (3) the Desert Thirst, experienced where water is lacking both as liquid and vapor, and where free salts external to the system are (commonly) absent. The third of these types is, of course, the most distinctive; and it is this alone which I have had opportunity to study in sufficient detail to warrant discussion. My data embrace personal observation on a score or more of thirsty men at divers times and in sundry places; reminiscences gathered personally from a dozen or more survivors of extreme thirst, and from a considerably larger number of men who have chanced to succor the thirsty; portions of the abounding

thirst-lore in the arid districts of Arizona, California, Nevada, New Mexico, and Sonora; numerous newspaper and magazine accounts — all more or less pointless and inaccurate; a few unwittingly faithful records like that of Manley in "Death Valley in '49"; conferences with men like artist Lungren, naturalist Merriam, litterateur Lummis, et al., who have both seen and felt; and — safest of all — several personal experiences, one extending over half way through the successive stages.

It is convenient to recognize five stages of desert thirst, falling into three successive stages: . . .

1. *The Stage of Normal Dryness.* The normal system deprived of water reacts mechanically with a sensation of dryness in mouth and throat, and instinctively in the general craving for liquid denoted as thirst; in conditions of extreme aridity and heat the sensation of dryness and the instinct of thirst frequently arise without actual deprivation in persons not inured to desert life. If not relieved, the initial condition passes into general uneasiness, discomfort, or irritation, accompanied by rise of temperature and other febrile symptoms. Commonly the condition is alleviated by a moderate quantity of water; sometimes fruit acids and other sapid substances exciting flow of liquid are requisite for relief; and in the practical life of the range a pebble or nail carried in the mouth is often efficacious. This stage — and phase — may be of little consequence save as the beginning of a series; it is experienced again and again by all men of arid regions, and excites annoyance rather than apprehension on the part of the patient, hilarity rather than pity among the company — it is the *clamorous* stage or the stage of complaining.

2. *The Stage of Functional Derangement.* In the incipient phase of pathologic dryness, a general febrile condi-

tion becomes marked and is accompanied by special local symptoms; saliva and mucus in mouth, throat, and nostrils becomes scant and sticky, and there is a feeling of dry deadness of membranes extending to the epiglottis and even into the lungs — the sensation of in-breathed air changing from one of refreshing coolness (the chief physical pleasure of life in the desert) to one of oven-like heat; the tongue may cling irritatingly to the teeth, or stick to the roof of the mouth; a lump seems to rise in the throat and starts endless swallowing motions to dislodge it; discomfort and pain run from throat to ears along the eustachian tubes and through the tissues; the tympana may snap and drum annoyingly, while the ear-openings itch and the eyes smart. There is a feeling of fullness in head and face (doubtless due to shrinking of skin) usually accompanied by headache and throbbing pains in the nape and down the upper spine; the hearing is disturbed and seeing capricious, so that illusions and hallucinations — especially the delectable pictures engendered by the desert mirage — spring constantly unless checked by connected effort; irascibility arises, and companions quarrel and separate; perhaps to reunite for the very satisfaction of further dispute; the solitary sufferer may soliloquize, largely in impassioned invective — though the voice becomes cracked, husky, or hoarse, and given to unexpected breaking into high tenor or dropping into an absurd whisper. The intellections are insensibly distorted more and more as the phase advances; prejudices are intensified, unreasoned revulsions arise against persons and things, while water and wetness are subconsciously exalted as the end of all excellence; the victim may gravely, after deliberate discussion in his quavering and ill-controlled voice, discard hat or shoes — for it is in this stage that Mexicans generally and Americans frequently begin to strip

themselves of clothing — or spurn the gold he has been seeking or the tobacco which has been his solace, or perhaps burden himself with a heavy cask or fragile demijohn. The face grows pinched and care-marked, the eyes bloodshot and perhaps tearful, the movements ill-aimed, the utterances capricious, while the temperature rises and the pulse quickens: the sufferer is a walking fever patient, passing or passed into a delirium usually wild and paralyzing in the tenderfoot, but concentrated on a central instinct in the desert habitue — the instinct of the trail, or the way to water. The disordered state of body and brain is often revealed by ceaseless talk; the sufferer strains tongue and throat to talk and talk and talk without prevision of the next sentence or memory of the last — and all the talk is of water in some of its inexpressibly captivating aspects. . . . Some of the party of thirst-dying men talk of portable apparatus for well-boring, of keeping kine by means of the bisnaga — a savagely spined cactus yielding poisonous water — and revelling in milk, of the memory of certain mint juleps in famous metropolitan hostelrys on the farther border of the continent, of the best form of canteen, (which should hold at least two gallons — three would be better); they were bright men, clear and straight and forceful thinkers when fully sane; and yet they knew not that their brilliant ideas and grandiloquent phrases were but the ebullition of incipient delirium. . . . It is called the *cottonmouth* phase of the disease and this phase is best relieved by water — water swallowed in quarts — water slushed over the face, head, neck, snuffed anon into the nostrils; and where conditions permit, hot coffee or soup, the nearer the scalding point the better. Some desert rovers limit the quantity — and wisely when the water is salt-charged or microbe-laden — though there is little risk to the habitue if the

water be pure; the tenderfoot may overcharge his system and so burden his heart and invite collapse next day. When water is scant it may be economized by a method well known in arid regions — that of alleviating local dryness of bucal and other membranes by sipping and sniffing a few drops at a time, and allowing the general condition to take care of itself. Many vaqueros and prospectors become artists in mouth-moistening and carry canteens only for this purpose and unwittingly follow the example of desert plants in habituating their external tissues to conservation rather than evaporation of the organic water; the sipped liquid lubricates the membranes, permeates both cavities and tissues, facilitates automatic swallowing of saliva and spitting of effete mucus, and compensates that evaporation accompanying respiration which most effectively controls the body temperature — as demonstrated by the sweatless but panting dog. On this empirical practice of the range even expert medicine may hardly improve; and unless complications arise, dry medicaments are useless — or worse.

The later phase of functional derangement is an intensification of the earlier; saliva ceases and membrane mucus dries into a collodion-like film which compresses and retracts the lips, tightens on the tongue until it numbs and deadens, shrivels the gums and starts them from the teeth, and shrinks linings of nostrils and eyelids giving irritating sensations of dust and grit; tears fall until they are gone, when the eyelids stiffen and the eyeballs set themselves in a winkless stare; . . . articulate speech ends, though hoarse moanings or weirdly unhuman bellowings may issue from the throat. Gradually the shrinking extends from membrane to skin; numbness creeps over the face, then over the hands and under the clothes, imparting a dry, rattling, husk-like sensation so nerve-trying that few longer resist the

impulse to cast off clothing in automatic outreaching for relief; the feeling of fullness in the head increases and extends to the chest; the sufferer spasmodically snatches at hat and hair and tears the scalp with his nails, while breathing becomes labored and gasping; the heart-beat grows slow and heavy, . . . the head throbs painfully, and excruciating twinges shoot down the nape and spine and through head and shoulders. . . With the advancement of this phase fever burns more and more fiercely; yet several observers have concurred in denoting it by perhaps the most distinctive local condition: it is the phase of the *shriveled tongue*.

In this phase, too, thirst is relieved only by water — water in gallons, applied inside and out, with caution as to rate lest the desiccated tissues be saturated so suddenly as to set up dangerous disorganization. . . In the absence of water little can be done! heart stimulants or nerve-tonics might be beneficial if available, although alcohol does more harm than good; the over-stressed system seems to respond sluggishly and slightly to ordinary drugs; . . . It is in this phase if not before, that most sufferers are led, either by aimless instinct, or the reasoned desire of keeping the membranes moist, to have recourse to urine — either their own or the still saltier stale of their stock; a desperate device which sometimes saves life at the cost of some poisoning of the system, but doubtless hastens the end of the uninured.

3. *The Stage of Structural Degeneration.* The passage of the thirst-patient into the earlier phase of this stage depends largely on his physical condition, especially the inurement to heat and dryness; the tenderfoot makes the transition quickly and completely, while the well-inured victim whose membranes and skin are toughened and habituated to conservation of organic water may resist the

tissue-disorganization up to and even beyond dissolution when the air is dry enough and the heat high enough — the dissolution in this case being a progressive mummification of the initially living body beginning with the extremities and slowly approaching the vital organs. In the ordinary case the fourth phase begins with an acceleration of the drying process due to the disorganization of external tissues; the collodion-like coating on the lips cracks open and curls up, and the clefts push into membrane and flesh beneath so that thickened blood and serum exude; . . . each cleft is a wound which excites inflammation, and the fissuring and fevering proceed cumulatively until the lips are everted, swollen, shapeless masses of raw and festering flesh. The gums and tongue soon become similarly affected, and the oasis in the desert appears in delirium when the exuding liquid trickles in mouth and throat; the shrunken tongue swells quickly, pressing against the teeth, then forcing the jaws asunder and squeezing out beyond them, a reeking fungus on which flies — coming unexpectedly, no one knows whence — love to gather and dig busily with a harsh, grating sound, while an occasional wasp plunks down with a dizzying shock to seize or scatter them. . . . Then the eyelids crack and the eyeballs are suffused and fissured well up to the cornea and weep tears of blood; and as the gory drops trickle down the shrunken cheeks are welted with raw flesh. . . . The agony at the nape continues, the burden of the heart-throb increases, but as the skin opens its pain passes away; the fingers wander mechanically over the tumid tongue and lips, and then they, too, begin to chap and swell and change to useless swinging weights. . . .

In this stage there may be little alleviation; even if the degenerated tissues are reorganized, the cerebral and neural

structures may scarce recover from the shock and the sufferer remains a gibbering imbecile for life.

In the final phase of desert thirst the external symptoms are but little changed. The benumbing and chapping and suffusion of the periphery and extremities continue and in this way the blood and serum and other liquids are conveyed to the surface and cast out on the thirsty air . . . and insects gather to feed on the increasing waste and the unclean blow-fly hastes to plant its foul seed in ears and eyes and nostrils, while the greedy vulture soars low and the ravening coyote licks his chops. . . A child in a single garment wandered out on Mohave desert, and was lost before the distracted mother thought of trailers; his tracks for thirty hours were traced and showed that the infant had aged to the acuteness of maturity in husbanding strength and noting signs of water, and had then slowly descended into the darkness and automatic death of the fifth phase of thirst — had at last dug the shadow-cooled sands with tender baby fingers, and then courted and kissed the siren cactus even unto the final embrace in which he was held by a hundred thorns too strong for his feeble strength to break.

In this final phase, there is no alleviation, no relief save the end; for it is the ghastly yet possibly painless phase of *living death* in which senses cease and men die from without inward, as dies the desert shrub whose twigs and branches wither and blow away long before the bole and root yield vitality. . .

THE CULT OF CONSERVATION ⁸

A new patriotism has appeared. It was born of Enlightenment inspired by International Comity. Fittingly, it

⁸ Reprint from *Conservation*, September, 1908.

first saw light in the land in which Enlightenment found birth in the principle of equal rights of all men to life, liberty, and the pursuit of happiness; yet its field of future activity is the world. Its object is the conservation of national resources; its end the perpetuation of People and States and the exaltation of Humanity. The keynote of its cry unto the spirit of men is **THE GREATEST GOOD TO THE GREATEST NUMBER FOR THE LONGEST TIME.**

The house of this nation was founded on Land. The Fathers saw no value, no means of enrichment in purse or enlargement of character in aught else; even their sons and their sons' sons sowed maxims and sang ballads assuring all the world that "Uncle Sam is rich enough to give us all a farm." Iron was a luxury from Sweden, steel a sybaritic morsel from Sheffield; coal was unknown, except as laboriously burned from willow as a dentifrice, or aspen for the furnace; petroleum and rock-gas were beyond dreams; forests were obstructions to settlement, the haunts of savages and beasts, and nigh unto a public evil. Every day was Arbor Day on which a youth won praise not by planting but by felling a tree — unless perchance the tree was a cherry tree and the chronicler of its fall a hero-worshipful Weems. Apart from men and their homes and fields, but a single resource was noted, and that merely as appurtenant to the land — i. e., the estuaries and streams used mainly for carrying over-sea commerce; which appurtenance happily inspired a Waterways Commission, yielded a Constitution, and established a Nation in a manner none foresaw save possibly Washington.

To the Fathers the Land, with its incidentally appurtenant water, was enough; they wanted little more — and none too much of that! George Rogers Clark and Benjamin Franklin were viewed askance because they brought into the infant country more territory beyond the moun-

tains than the strip for which the Fathers fought along-shore, and Jefferson was all but sent to Coventry when he bought an empire for a song — just as within our own memory "Seward's Folly" was a synonym for resourceful Alaska, and even within a decade McKinley and Wilson and Day were derided for opening over-sea lines for our teeming growth. Lulled by woodland zephyr and prairie breeze, the pioneer forgot Eden and its penalty in the sweat of his brow for the posterity of men; revelling in boundless acres, he even forgot the line of his loins, and cravenly and impotently swore, "Posterity be condemned! Let posterity take care of itself!" Thus he blasphemed the blood of those who fought for Land and Liberty, and foolhardily jeopardized the Nation woven of their lives! So patriotism waned.

Yet posterity spread apace over fair America; for the fruit of the ages was ripe unto the harvest. The half of what he did not eat the settler wasted, and most of the rest he turned over to budding trusts to be used in shaping shackles for his own ankles and wrists; so that after thirteen decades of the freedom for which the Fathers fought, certain seven men — none chosen of the people — hold in their hands the industrial and commercial destiny of more than eighty millions of citizens! So substance was scattered away and tyranny trained up.

A new revolution began — for every revolution is at bottom mental — when citizens saw in a decade past that ravage of woodlands sacrifices streams. Already the story is old. There is still wood enough to last half a lifetime at the current increasing rate, and it is growing a quarter as fast as cut; but the homestead spring has dried up, the mill-stream has shrunk to a slimy thread, the old-time dell is torn by storm torrents, the river is beset by bars, the river-side

field caves into the flood a rood at a slump, while the richest of the soil washes into the sea at the rate of half a ton each acre-year. Such is the lesson of the disappearing forest; naturally it led first to uneasiness, later to full awakening; and at last to an inventory of resources, and an analysis of their relations.

During the thirteen decades of American independence, domestic iron production has increased from nearly nothing to over 50,000,000 tons per year; the consumption from less than ten pounds to 1,300 pounds per capita. The original stock was some 10,000,000,000 tons; and while about 750,000,000 tons have been consumed and wasted to date, if the current rate of increase continues the annual production will within thirty years reach more than half that amount — and before the end of the present century our iron will be gone.

When the Declaration of Independence was signed there were in what is now mainland United States about 2,000,000,000 tons of coal — then but a useless black stone, of which little was used until within a century. Already some 9,000,000,000 tons have been wasted and destroyed, and 7,500,000,000 have been consumed in ways so wasteful that less than five per cent of its heat value has been turned to useful account. The consumption is increasing beyond belief in any earlier decade; the mere increase in 1907 over the use in 1906 was greater than the total consumption in that Centennial Year (1876) in which America became known as a leader among the world's manufacturing nations. In 1907 some 450,000,000 tons, or over five tons per capita for our 84,000,000, were taken out of the ground; and if the current rates of production and increase continue, all will be gone by the end of the next century. And still more woeful is the tale of oil and gas, already largely squandered!

The birthright Land of the thirteen Colonies for which the Fathers fought comprised some 200,000,000 acres, of which full half was felt forever worthless save for rocks and swamps and trees; but the remaining 100,000,000 was thought enough for the Nation for all time. With the Clark-Franklin claim allowed at Geneva, Jefferson's Louisiana Purchase, the Florida acquisition, the Oregon discovery and the demand (less the spiritless surrender) of "Fifty-four forty or fight," the California conquest ratified at Guadalupe Hidalgo, the Gadsden Purchase, and the Texas adhesion, the estate increased ten-fold. . . . Today "Uncle Sam's farm" is virtually gone; no more arable acres remain to be given away. Whenever a vacated parcel is opened to settlement, it is seized in a day by soul-searing gamble or disgraceful rush or paralyzing wait-in-line. Except as Science bids the desert blossom or commands the field to yield two ears of grain where a blade of grass grew before, the limit of the land has been reached.

When the American Constitution was framed on the foundation of interstate waterways, the rain fell on the just and unjust alike, little checked by either; now the interstate rain is the basis of prosperity, and a coming foundation for even closer union among the People than that written down in the Constitution. Some 200,000,000,000,000 cubic feet of rain descends from the heavens each year on the 2,000,000,000 acre farm of mainland United States; and with a half or even a third of the acres to receive the boon, were it equally distributed the population and productivity, the manufacturing and merchandizing, might be great as they are — with an advantage in reduced cost of transportation. Nominally, lands sell by the acre or foot; actually the price within ten per cent is fixed by the associated water. In verity the 200,000,000,000,000 cubic

feet of annual rainfall is the sole effective capital of the country; without it the land would be a desert, devoid of tree or shrub or other living thing. More than half of all is evaporated to temper climate, form dews, and re-descend elsewhere; a fifth goes down to the sea in rivers, say an eighth is stored for a time as ground water; the remaining twentieth, or a half of a Mississippi, is stored or used in the ontosphere—in the living structures and functions of animals and plants. The time of storage is short; an animal may survive a week, a humid annual plant six weeks or a tree six months without renewed supply; springs fail and brooks run dry under a three-months' drought. Were a rainless year to come, half the lesser rivers of America would dry up; within seven such years in succession, the Mississippi and Colorado would cease to flow, and within ten the lake-fed St. Lawrence and Columbia would be no more. While the witchery of water still appeals—and all the more by reason of better knowledge—the days of witchcraft and mystery of waters are numbered; for Science has arisen to show the sources of spring and well and brook and river, of flowing sap and pulsing life-blood—and all run back to the life-giving benediction of the clouds. Yet because the grand-sires of the Fathers were from riverless islands of ample rains and virtually waterless statutes, they and their sons were slow to see natural wealth in water; and it is the irony of American history that the interstate waters which yielded a Constitution were half-forgotten for a century—before a realization of their value arose, begotten of bitter experience in arid regions. For the deepest impulses of Humanity have been inspired by water in dearth rather than abundance; the altruism of which Civilization is the fruit bloomed first in the world's deserts—and necessarily so.

The rivers of America form ways of commerce, virtually abandoned through legislative ineptitude and an administrative apathy now happily ended; and in their natural head lies power, far beyond that of the hundreds of millions of tons of coal consumed each year, of which but a fraction is harnessed — and most of that monopolized. Their freshets due to deforestation destroy houses and goods to the value of \$150,000,000 annually; their increasing impurities cost lives in thousands; their myriad feeders lick the cream of the soil from the Nation's fields to the measure of a billion tons a year, cutting down the annual crop-yield grievously — say from \$8,000,000,000 to \$7,000,000,000. The destruction wrought by waters running wild is vast; the half of an average year's loss applied over a decade of judicious improvement would tame them forever, terminate their destruction for all time, and bring the Nation's richest resource under complete control. How long will the folly of sluggardly somnolence continue? How long will the People permit the penny-wise pound-foolish policy to persist? How long — how long!

When the lotus-eaters forgot the travail of the Nation's birth, and condemned their own posterity to perdition unknown, national spirit oozed out of their idle fingertips. They wasted what Nature saved through the ages, scattered that which their sires garnered, ceased to consider the fate or even the fact of posterity — so that the very blood of the birthright Land is become of alien tincture, and homes are given over to foreign Lares and Penates. Thus unity grew lax, and patriotism weakened; standards of morality sank below normal instead of rising steadily as is their wont; and the budding notion of national efficiency was chilled back. Monopoly sought to enslave citizens to its sordid behest, and workers retaliated by restricting their own ca-

capacity to that of the most incompetent of their class, whereby actual efficiency — which grows by exercise — was lowered. The industrial twins, Labor and Capital, quarreled and disturbed the national household by their bickerings and anathemas of each against the Mother of the other; and from darker corners Anarchy thrust a hideous head. Yet, as deeper darkness presages dawn, the enfeeblement of national spirit but made way for the new era in which Patriotism looms loftier and larger than ever before — and with farther foresight. No longer able to dispense acres equally to all, the Nation instead affords equal opportunity for all to develop a wider range of resources. Today there are four foundations for prosperity in lieu of one. The Land remains, and in increased worth by reason of intensive treatment rather than extension of settlement; the Forests accumulated above-ground during the centuries and the Minerals below-ground during the ages have acquired worth through the orderly growth and natural development of the country; and Water is coming within ken as the basis of prime values on which all others must depend, and as an inalienable birthright of the People — a common heritage for the common interest, to be administered by Nation and States jointly as befits its interstate character, but never to be withdrawn or withheld from direct control by citizens for their own common good.

Just as the land for which the Fathers fought was at once the tangible basis and the inspiration for patriotism in an earlier day, so in this day the birthright Land, the soil-making Forests, the native Minerals, and the life-giving Waters inspire Patriotism anew. Each is well worthy of story and song and shrine; and each inspiration is warmer and the whole are knit in closer union by reason of each other. . . .

THE FIVE-FOLD FUNCTIONS OF GOVERNMENT⁹

I

Organizations, like organisms, are products of development. Governmental organizations, like most others, are increasingly designed and shaped in the light of conscious experience. Thus, the constitution of the United States epitomized the lessons of history so far as recognized by its framers, whereby the instrument became the embodiment of governmental practice and theory gained through known experience. Naturally, by reason of the ability of the framers and the stress under which they wrought, the instrument is notable — certainly among the most notable ever produced, whatever may be thought of Gladstone's view as to the divinity of its inspiration. Naturally, too, the framers specified most clearly those governmental powers with which they were familiar and which they most desired to adopt; and, no less naturally, their action was guided quite as much by the desire to eliminate that which they thought objectionable as by the aim to perpetuate that which they deemed desirable. Seeing that government is an expression of law, their first care was to provide for the framing of laws, the second to provide for the execution of these laws, and the third to provide for the interpretation of law; and in this way arose what came to be known as the "three co-ordinate branches" of the United States government. The branches are indeed coördinated, though they are far from coequal, since the power of creating the third is entrusted to the second "by and with the consent" of a part of the first; yet they by no means constitute the entire government — as becomes clear in the light of earlier phases of social organization made known largely since the instru-

⁹ Reprint from *Popular Science Monthly*, September, 1910.

ment was framed, no less than in that of discussion before and during the framing of the constitution.

Early in that primitive social type in which tribal organization rests on consanguinity traced in the female line, the elder-woman is both law-giver and judge, while her elder-brother acts as an executive in case of need, and the two jointly or severally exercise administrative authority throughout the clan; later the elder-women become priestesses or seeresses still giving and interpreting the clan laws, and their elder-brothers form an avuncular council of gradually increasing administrative and executive powers; yet at every step all primary power is imputed to a mystical pantheon of which the beldames are only vicars and the sages merely indirect agents. In the next stage of development (*i. e.*, in the patriarchate, in which organization rests on consanguinity traced in the male line), the elder-man becomes vicar or priest, and hence law-giver and judge as well as both administrative and executive — as when a patriarch communes with his deity over sacrificing a son or a daughter, or a kalif commands of his own impeccability, sits in judgment, awards and rewards, imposes and deposes, and (like a later emperor) personifies the state; yet his primary power is imputed mainly or solely to that supernatural source of which he is deemed but the agent. With the growth of cities and those civic usages in which the organization arises in proprietary right (especially in lands), rulers long remain vicars of mystical or spiritual powers manifested in symbols and ceremonies though often exercised through arms and armies; and until within recent centuries each monarchy was virtually a hierarchy whose king or emperor stood — panoplied in the “divinity which doth hedge about a king” — as the source and exponent of both temporal and spiritual power, performing so much as

he would of all governmental functions, his rule ranging from hierarchic to autocratic according to the faith and custom of the time. Gradually (the rate being accelerated by the American Revolution) the monarchs surrendered legislative functions, delegated judicative powers, divided administrative and executive duties with the agents of courts and parliaments, sometimes shared their vicarial powers with ecclesiastic potentates, and began yielding to the inevitable growth of petition into suffrage; yet no monarch was ever quite independent of putative supernatural powers residing within or conveyed through his own personality, or of the symbolism or ceremonial tending to perpetuate the imputation.

In brief, during each stage of governmental growth from the simplicity of primal clan to the pomp and circumstance of gilded empire, the primary functions remain much the same despite sweeping changes in structure. In logical order the functions are (I) initiatory, and (II) directive, the former connoting the source and the latter the aim or control of constitutional power. In genetic sequence, or in that order of successive manifestation illustrated, *e. g.*, in the natural family of which the clan, gens, city, and nation are outgrowths, they are (1) *administrative*, or concerned with the current regulation of every-day affairs; (2) *legislative*, or concerned with the establishment of rules of conduct (always finally adopted only through common consent); (3) *judicative*, or concerned with the peaceful settlement of disputes in accordance with custom and established rules; (4) *executive*, or concerned chiefly with the carrying out of rules and judicative decisions; and as the natural source of power gradually comes into ratiocinative view in the light of the general good, (5) *determinative* or concerned with the primary expression of common judgment and desire.

Now when the founders of the American nation undertook to frame a governmental organization, little was known of the natural stages in the course of human development. The notable works of Maine and McLennan on primitive law, of Fustel de Coulanges on "The Ancient City," of Lewis H. Morgan and Herbert Spencer and Auguste Comte on early society, and of Taylor and Powell and Brinton on lowly religion had not been written — indeed the epoch-marking investigations of these and other writers run back to the unprecedented efforts of the American revolutionists to ascertain the ultimate foundations of human government, efforts not disparaged but only accentuated by the rapid growth of human knowledge since they were made. Since then, science has come into being on the earlier foundation laid by Bacon and Linne and a few others: of the five cardinal principles of science (outlined in an address of the president of the Anthropological Society of Washington, delivered before the Washington Academy of Sciences and affiliated societies February 19, 1900), the first (the indestructibility of matter) was established by a contemporary of the Revolution, Lavoisier; the second (the persistence of motion) grew out of Rumford's experiments begun under the influence of this American renaissance; while the others (the development of the species, the uniformity of nature, and the responsitivity of mind) came scores of years later — indeed nearly all of the current branches of science have arisen since the Revolution. Since then, too, historical knowledge has been both expanded and refined; geographic knowledge has extended over the full half of the earth then practically unknown; invention has revolutionized industries, largely through American example; steam and electricity and high explosives have been harnessed; the world's population has doubled; man's conquest over na-

ture has advanced further than during all earlier time; statecraft in the modern sense has taken form, and diplomacy has been reconstructed, both largely through the world-touching influence of the seventh and eighth decades of the eighteenth century; and the American governmental model has been adopted in spirit if not in form by far the greater part of the nations of the earth. In the light of the vast advance since 1776, the sagacity and courage displayed by the signers of the declaration and the articles of confederation, and especially by the framers of the constitution, shine forth among the greater marvels of human history.

The founders included eminent scholars and statesmen, yet they were practical men confronted by problems of which the issue meant life or death; and on surveying the field of experience in governmental organization within their reach, they seized on the essentials and wisely withheld their hands from both the collateral and the controvertible. Dwelling long on the pressingly practical (as shown by the record of discussion in the constitutional convention) they defined clearly the legislative and executive and judicial functions of the nascent government, leaving the then relatively unimportant details of administration — over which controversy arose whenever the subject was approached — to the sense of their successors; while they proceeded so circumspectly as to reveal implicitly rather than by explicit statement their chief — and history's greatest — contribution to governmental principle, *i. e., the substitution of human power exercised through an electorate for the inscrutable might manifested through a hierarchy* as the basis of government. Strong as is the constitution in every feature and department, its chief strength lies in that last-written but first-placed paragraph, "We, the people of

the United States, . . . do ordain and establish this Constitution." With this utterance the mysticism of the ages fell away, and the foundation of humane government became fixed forever; and the new light has already gone around the world and entered every land.

Now in addition to the specific powers expressed in the first, second, and third articles of the constitution, others are so clearly implied or expressed *inter se* that they were unhesitatingly exercised from the day the instrument was adopted. These embrace the administrative power implied throughout, together with that primary power ranking all the others combined (since they rest on and arise from it), *i. e.*, the determinative (or elective) power implied in the first, second, fourth, fifth, and sixth articles and expressed in the preamble. So any complete enumeration of the powers of our government (or any other representative type) necessarily comprises those pertaining to the five innate and coördinate functions involved in all governmental organizations from the most primitive to the most advanced; in logical order — which is that reflected in the constitution — they may be denoted (1) *elective*, exercised by the people; (2) *legislative*, exercised by the congress; (3) *administrative*, exercised by the president and his cabinet officers; (4) *judicative*, exercised by the court, and (5) *executive*, exercised primarily by the president.

II

The popular movement for the utilization of our waterways first marked an awakened public sentiment; now it is stirring the national conscience in a manner not unlike the movement of 1776. A round century of public indifference since Gallatin followed Washington in pointing a way, and a half-century of national incompetence attested by the de-

cline of river and canal navigation — these unwittingly set the alarm now ringing. As befits democracy, the awakening began with the extremities of the body politic; yet signs are not lacking that it is reaching the somnolent centers. When the declaration and the constitution were framed, the sense of citizenship still lay dormant in all but a few leading minds, and in some of these soon turned sluggishly for longer slumber; then the legion prodigals were fed with the swine on husks of party welfare rather than on the sound corn of public weal until a shadowy “no-man’s-land” grew up between citizen and state and a “twilight zone” spread between state and nation. Yet, stirred at last by the waterway movement and a forest policy uniting in the cult of conservation, the people are at last preëempting the shadowy middle ground, and thus coming into their own as citizens. Two years ago (1908) the governors — the actual sponsors for the welfare of their commonwealths — felt the stir; they responded vigorously, and now they and their people are moving together against a tyranny of regnant apathy not greatly different from that of his ease-loving and privilege-giving majesty George III.

Within a few months the congress began to respond to the popular demand by authorizing the publication of reports of the Inland Waterways Commission and National Conservation Commission and the Proceedings of the Conference of Governors; then the senate created a strong committee on the conservation of natural resources; and within a month this committee reported favorably a bill for the establishment of a “National Commission for the Conservation of Natural Resources.” The report meets the popular movement half way, declaring that “The measure is designed to conform with various actions, both legislative and administrative, growing out of one of the strongest popular

movements in the history of our country," the document outlines the movement, summarizes the nature and extent of our natural resources, indicates the leading wastes and industrial diversions attending development of resources, and concludes with a plan for action framed to meet the people's will. Even more significant than the body of the report is the appendix; for at last the senate has yielded to the voice of the people sufficiently to print the expressions adopted in great conventions of citizens — among others, the declaration of the Fourth Deep Waterway Convention (adopted in New Orleans November 2, 1909) "comprising duly appointed delegates to the number of 5,000 from 44 of the 46 states of the union, including the governors of a majority of the states," which finally turned over a new leaf by recognizing and declaring the rights of citizenship to "demand and direct" action by their representatives — in lieu of the far lesser rights of subjecthood to "petition" or "submit" or "respectfully request," or "forever pray" with which Americans have been content for a century — and then nailed down the new leaf by the public pledge of personal honor proper to full citizenship! Surely if these 5,000 delegates mean what they say — and who can doubt their sincerity? — no more significant utterance has been made on American soil since the declaration of July 4, 1776. The final paragraph of the declaration reads:

Believing in our hearts that the needs of the country and the fundamental principles of the government set forth herein involve moral no less than material issues, and believing that the time has come for us and the other citizens we represent to exercise our constitutional powers by the means provided when the constitution of the United States was framed, we, the delegates in this convention assembled, representing more than half the people and three-fourths the productive energy of the United States, do hereby deliberately and firmly, and in the full realization of our duties and responsibilities, demand and direct that a definite and vigorous policy of water-

way improvement beginning with the Lakes-to-Gulf Deep Waterway, be adopted and put into operation by the national government without delay. To the enforcement of this demand we pledge our individual effort and our united support; and we hereby publicly pledge our public honor, each for himself and to each other, to support no candidate for public office who will not unqualifiedly endorse and maintain that policy.

Academically, such an utterance is in so full accord with the constitution and with the principles of popular government as to be common-place; actually it is so far out of accord with current governmental methods that the third of the representatives and senators in attendance at the convention generally (except perhaps a dozen progressives) repudiated and condemned the utterance of the measure more or less openly as "socialistic" or "anarchistic." Still the voice of the people has echoed and reechoed; and at last it has reached print in a public document.

The spirit of the Lakes-to-the-Gulf Deep Waterway Association expressed in their declaration has cropped out in various conventions other than those noted in the senate report. During the past two years the question has been growing more and more incisive, Is this nation competent to protect the interests of the people? The question has been pressed in non-partisan assemblies held in every section, including citizens of every state, and with constantly increasing directness and pointedness; and it is a sign of the times that it is put with a sense of power and a realization of responsibility unprecedented in the century and a quarter since Washington moved towards the constitution. America — the collective mass of ninety million souls — is a long-suffering if not lethargic giant, slow to wrath and show of strength; yet as to its power when aroused — who can doubt? Its full strength lies in the spirit of the ninety millions; the force of a first effort lodges in some eighteen

million voters, the half temporarily tied by one special interest or another — but nine millions are full freemen, and five millions more are ready to follow their lead. Now that the giant is aroused, in conscience no less than in sentiment, the demand of the people is attracting attention. Already the waterway advocates can point to a partial response to their demands in enlarged provision for river surveys, in provision for a national waterways commission empowered to extend and apply plans framed by the last administration, and in a recent declaration of the administrative and legislative authorities that “pork barrel” appropriations must cease — indeed, to the longest steps in the right direction since Washington prevised and Gallatin planned and Windom pleaded for rational waterway development. Verily, the waterway workers have not wrought in vain!

The significant fact lying behind the past and prospective legislation is the power of the people when once aroused — a power not to be confounded for a moment with that of tumult or mob, but inhering in the very spirit and lodging in the innate structure of democracy. True, this power is too often ignored by those for the moment responsible for the public welfare, too little felt by its own possessors; it is seldom stirred save by war or rumors of war, rarely tempted to exercise save by partisan calls at times of political stress; yet although a virtually neglected factor of our national life, it is worthy of weighty consideration.

III

The first, second, and third articles of the constitution, respectively, define the legislative, the executive (including the administrative) and the judicative functions of government. The specifications of the executive function are gen-

eral to the point of vagueness — naturally enough, to the then current antipathy to concentrated authority. Few matters were so faithfully discussed during the constitutional convention as the powers of the president; and few of the discussions better exemplify the superlative caution which constantly led the delegates away from definite specifications and towards bare generalities in compromising mooted points. So, just as the instrument is silent on the primary governmental function save in the preamble, the commonplace functions of administration are implied rather than explicitly stated in the second article — being most clearly (or most nearly) defined in the oath or affirmation by the president-apparent that he will “faithfully execute the office of president,” which “office” manifestly covers minor governmental affairs, not otherwise specified. The indefiniteness was not due to inattention or indifference concerning the administrative function, as the debates clearly show. . . . Unhappily the indefiniteness begat uncertainty, which has multiplied with the growth of the country; for public affairs requiring administrative attention tend to increase geometrically (just as do transportation lines) with the number of individuals and communities touched. Under the natural desire to protect prerogatives and with a facility due to the weight of numbers, the congress gradually grew inattentive to the first duty of the president under the constitution (“He shall from time to time, give to the congress information of the state of the union”) and drifted into the habit of obtaining “information of the state of the union” by more cumbrous methods directly through their own committees or indirectly, (and of course unconstitutionally), from the administrative departments. Moreover, they increasingly ignored the warning of George Washington (the presiding officer and moving spirit in the

constitutional convention) in that ever-memorable farewell address read annually in their hearing: "Let me . . . warn you in the most solemn manner against the baneful effects of the spirit of party generally . . . the alternate domination of one faction over another, sharpened by the spirit of revenge natural to party dissension . . . serves always to distract the public councils and enfeeble the public administration" — so that the nominally representative congress has virtually ceased to act in behalf of the people and come to act instead in behoof of party, in ways for which no shadow of constitutional warrant exists. It would appear that the gravest apprehensions of Washington and Morris have been realized in a policy of special legislation so pronounced that — *mirabile dictu!* — fully 99 per cent of the bills introduced during an ordinary session are special, local, or personal in whole or in part, while far the larger part of the committee work and public debate appear to be devoted to special or local interests! Naturally little time and thought are left for general laws, touching alike the entire citizenry: and naturally the custom of special legislation under party control opens easy way for such machine organization that a half-dozen shrewd manipulators may assume leadership in either house and completely dominate legislation. So far has this tendency run that it is today a grave question — the gravest in our history — whether our current laws are framed in the interests of our ninety millions or in the interest of special privilege reducible in the last analysis to a scant dozen "captains of industry"; and hence whether after all representative government is inherently and permanently stable. The "propensity" of the congress "to legislate too much" has indeed been checked from time to time in the manner forecast by Morris; for while some administrations acquiesce,

others hold out for a stricter conformity with the constitution. George Washington sought to carry out the intent of the instrument framed under his chairmanship, and was so savagely assailed for "usurpation" that he declared death preferable to public service; Abraham Lincoln carried forward the administrative affairs of his terms through sheer force of personality, aided indirectly by the military activity of the time; no less competent authority than the present president of the United States once signalized Grover Cleveland's insistency that the presidency carries power coequal with those of the congress as *the* notable feature of his administrations; and Theodore Roosevelt's policy was consistently parallel and still more vigorous, even to his final and most trenchant presidential message pointing out the unconstitutionality of an item in the sundry civil act passed as his term closed. Meanwhile some heads of executive departments shrank from assuming administrative responsibilities; yet under growing necessity they have gradually become our chief administrative officers.

Verily the price of indefiniteness as to the administrative function in our fundamental law has been large! Not only have confusion and friction arisen, with enormous attendant expense, but the relatively simple duties of administration are ill-performed. The advocates of waterway improvement were among the first to notice that nearly all our waterway enactments to date are special, and tend to magnify rather than merge sectional and political interests; and that the flood of special bills and local items has so far diverted effort from general legislation that even unto this day the country lacks fundamental laws relating to waters, and is weakly perpetuating monarchical common-law doctrines not only unsuited to current conditions but such as

the constitution was designed to annul and forestall. The waterways workers are no longer slow to condemn methods which have permitted — if indeed they have not caused — the decline and disappearance of navigation from the finest river system of the world in a country suffering from the lack of transportation facilities. Already a majority of states are moving, and many citizens are astir; and the prevailing sentiment runs along the lines forecast century-before-the-last by Gouverneur Morris and George Washington.

IV

When popular assemblies “demand and direct” action relating to waterways, regardless of party and under a suffrage penalty, the awakening means more than mere recognition of bad legislative and administrative methods; it extends to that innate and primary power seized on by the founders as a substitute for the “divine right of kings” — *i. e.*, the power of the people defined in the preamble to the constitution and exercised through suffrage. While this power has existed throughout our history, the act of suffrage is the last to be realized as essentially fundamental — indeed as the supreme function of democratic government. The spirit of free citizenship arises slowly; to the anthropologist it is the latest self-conscious attribute acquired by mankind in that long course of human progress stretching from the prime to the present. Even in our Atlantic tide-water states, the real home of democracy, few citizens feel the franchise as in and of itself a function of government; in oratorical flights they hear and even declare that ours is a government of the people by the people for the people, yet only the exceptional citizen actually *senses* the casting of his ballot as a function no less governmental in character than those delegated thereby to his fellow-citizens act-

ing as president and representative and judge. Now this is the sense stirred by the non-partisan waterway and other conventions particularly in the newer states west of the Appalachians; it is the sense stirred as well in Des Moines and other municipalities governed by the commission system carrying provision for initiative and referendum and recall — the sense of innate *power* exercised through the elective function.

Concurrently with the sense of power the realization of rights is arising; and naturally enough, first as to the waters. Finding nation and most states apathetic, the more progressive waterway advocates looked into fundamental questions for themselves; and now, as a member of the supreme bench recently declared half querulously, "The country is full of constitutional lawyers." Five years ago, a few citizens cared to consider the ownership of water in itself; today tens of thousands are familiar with the tenth amendment ("the powers not delegated to the United States by the constitution, nor prohibited by it to the states, are reserved to the states respectively or to the people"), and hold that since this resource was never granted to the nation or conveyed to the states it necessarily belongs to the people as a heritage no less indefeasible than the common title to sunlight and air, or indeed the equal rights to life, liberty, and the pursuit of happiness; and three great conventions during the last year adopted in substance the water plank made public by the senate committee on the conservation of natural resources.

We adhere to the principle arising in our constitution and incorporated in statutes recently enacted in several states that the waters belong to the people, and maintain that this right of the people is inherent and indefeasible; and while recognizing the necessity of administering this invaluable possession of the people by state and federal agencies, each within its appropriate jurisdiction, we deny

the right of municipalities or of state and federal governments to alienate or convey water by perpetual franchises or without just consideration in the interests of the people.

With the sense of power and the realization of rights, the consciousness of duty is spreading. Until recently, provision for waterway appropriation was commonly deemed chimerical; and citizens were led by advice of their representatives and the policy of congress to look on local appropriations as sports of conquest rather than general contributions to the public good — whereby the “pork barrel” was kept open and appropriations went for “works” with little regard for actual navigation of the waters. Now, seeing that despite the expenditure of hundreds of millions on waterway “works” navigation of the rivers has declined, the people demand business-like methods whereby public funds shall be expended only for commensurate public benefits; and since the people have spoken, presidents, governors, and probably a majority of the congress are concurring in the wisdom of issuing bonds to cover the cost of continuously and increasingly beneficial public improvements. Almost never before has the issue of bonds been contemplated without more or less open guarantee from Wall Street; but now legion citizens clamor for opportunity to share public burdens directly on a patriotic basis rather than indirectly through the expensive medium of special interests — for in the end the people pay. Under this pressure bills have already been introduced in the congress providing for waterway improvement on the basis of bonds issued in small denominations bearing interest too low to tempt bankers and brokers; and the adoption of this popular policy promises to mark America’s most definite step toward making her citizens joint owners rather than passive tenants of their common country, and thereby at once

raising patriotism to a higher plane and insuring stability of the nation.

The recognition of rights and duties respecting the waters leads to juster appreciation of other resources, which were of no account when the constitution was framed but have acquired value through the natural growth and orderly development of our population and industries; and today several of our forty-odd state conservation commissions hold that in legislative or other action looking toward wiser use and conservation of the natural resources the people are but protecting their own. The growth of the sense of common welfare has been greatly impeded by court decisions based on common-law doctrines which the constitution was designed to displace, decisions sometimes tincturing later legislation; yet several courts have fairly kept pace with the growing sense of eternal equities among the people — they who adopted the constitution partly to provide a judicative mechanism adapted to their own needs and subject to their own supreme will: The decision of the supreme court of Maine that the public are entitled to a voice in the management of forests affecting stream-flow; the finding of the New Jersey court of errors and appeals, sustained by the supreme court of the United States, that the people have a residuary right in the waters; . . . these and other decisions tending toward closer union of interests among all the people are signs of the times. . .

The waterway and conservation movements are still young, and may reasonably be expected to contribute continuously to that public welfare by which they were inspired. Whatever they may be in the future, they have already done much. They have revealed to the people a growing sense of their own powers and rights and duties as citizens; they have brought to light and started toward rectification our ineffective if not actually repressive meth-

ods of administration by legislative machinery; they have shown the inherent rights of the people in and to those material resources given value by their own work, and on which their own prosperity and perpetuity depend and thereby they have warmed the spirit of unity among citizens and states; they have stirred patriotism more than any peaceful issue before, deeply as only bloody war has done in the past; incidentally, they are surely establishing the elective function as the primary power of representative government, and will no less surely establish the administrative function as correlative with those of legislative and judicative character.

FLOOD PLAINS OF RIVERS ¹⁰

Fire, flood, famine, war, and pestilence were long reckoned foremost among the evils to which mankind is subject. With the growth of knowledge concerning the relations of man to his environment, and with the development of far-sighted altruism, men have united in devising and applying means for suppressing, or at least opposing, four members of this maleficent family. Fire is provided against by numerous devices adapted to all modes of life and to all stages of culture; by legislative enactments and municipal ordinances in civilized nations, and by special organizations of men and appropriations of money throughout the more advanced countries. Famine flies before the community of interests and the ready interchange of products that measure the advance of nations in material and moral development. War in most countries is opposed by two of the most potent determinants of conduct, namely, private principle and public policy; and of late a powerful movement toward the

¹⁰ Reprint from *The Forum*, 1891.

abolition of war among civilized nations has been gaining strength. Pestilence is weakened by combinations among men for mutual aid, it is crippled by the decadence of personal and national strife, and it is disarmed by cleanliness of modern times. Even now biology and medicine are uniting to invade the last stronghold of this evil agency. They are isolating her protean germs, laying bare her insidious processes, turning her own weapons against her by opposing bacterium to bacterium and ptomaine to microbe, and if the signs of the times are not misleading, are surely encompassing her downfall. Fire, war, pestilence, and famine have been successfully met by human ingenuity, foresight, benevolence, and sagacity; but the flood remains, a barely mitigated evil, a hardly-appreciated obstacle to progress. Indeed, as population has increased, men have not only failed to devise means for suppressing or escaping this evil, but have, with singular short-sightedness, rushed into its chosen paths.

A fertile bottom land was the goal of the American pioneer, as he bent his tedious way from the Atlantic seaboard across the mountains and into the broad basin beyond. Moreover, his course was constrained by hills and forests to the valleys of rivers and streams. So it happened that the early homesteads and settlements were located on the flat and fertile plains flanking the waterways, and that the early routes of travel traversed the same plains. Thus, in one stage of the settlement of the Mississippi Valley, the population was confined mainly to the narrow belts of alluvial land skirting the streams.

As time passed, isolated homesteads grow into settlements, and settlements into towns; and as the towns waxed in population, wealth, and trade, some of them became cities. Meantime the bridle paths and wagon trails of the earlier

periods were transformed into stage routes and turnpikes, and at the same time navigation was established on the larger streams. Yet in this stage, as in the earlier one, the centers of population and the lines of travel and traffic were confined to the waterways, and only a small proportion of the nomadic and agricultural population pushed into the forest fastnesses of the uplands. During this stage such cities as Wheeling, Cincinnati, and Louisville came into being on the Ohio; and as the border land between the white settlements and Indian hunting grounds slowly advanced, such cities as St. Louis, Keokuk, Dubuque, and La Crosse on the upper Mississippi, La Salle and Peoria on the Illinois, Terre Haute and Vincennes on the Wabash, St. Charles, St. Joseph, and Omaha on the Missouri, and a score of lesser towns on a dozen other rivers, were planted. But during the earlier era of overland staging and river navigation, as during the earlier era of pioneer travel, settlement followed the waterways, population gathered on the river-side plains, and the uplands were sparsely inhabited or quite unsettled; so that, despite the greater area of upland, the larger part of the population was concentrated on the lowlands.

A third stage in the settlement of the Mississippi Valley was characterized by steam locomotion. During this stage the railways were first extended along the smoothest lines and through the largest towns, thus adding to the population and wealth already accumulated on the alluvial lowlands; and steam navigation coöperated with steam railway in accomplishing this end. But later the railways were pushed out over the uplands, carrying trails of settlements in their divergent courses; and at the same time the influence of river navigation waned. This stage was that of the dispersion of population, and it has reached to the pres-

ent time; yet today, as during the earlier stages in the occupation of the Mississippi Valley, population continues to follow the rivers, and cities, towns, and homesteads are found on the alluvial lowlands by which the rivers are flanked.

It would be interesting to determine the relative density of population upon the riparian lowlands and upon the intervening uplands, not only within the Mississippi Valley, but throughout the United States; but the data are inadequate. Only limited areas are mapped with such accuracy as to distinguish between lowlands and uplands, and even in these the cities stretch from lowland to upland, the towns often stand on slopes, and the civil divisions by which the rural population is enumerated are independent of physical boundaries; so that without a special census the common population cannot be divided. A rough evaluation of the relative areas of alluvial lowlands and intervening upland in the eastern half of the United States, and a still rougher estimate of the riparian and non-riparian population, may, however, be made. Detailed maps of typical tracts indicate that from five per cent to fifteen or twenty per cent, or an average of about ten per cent of the given area may be classed as alluvial land. Probably this ratio may safely be extended to the 1,500,000 square miles of the eastern United States, exclusive of the delta plain of the Mississippi. This single alluvial tract is 1,100 miles long, measured on the river, or one-half as long, measured in a direct line; more than 100 miles in average width; and fully 60,000 square miles in extent. The total area of alluvial lowlands in the eastern half of the country would thus appear to be not less than 210,000 square miles, or fourteen per cent.

The concentration of population upon alluvial lowlands,

commencing in the interior with the arrival of the pioneer, is still notable, and is displayed in New England, and along the Atlantic seaboard, in the Gulf states, and on the Great Lakes, as well as in the Mississippi Valley. Eighteen of the twenty-one principal cities and towns recorded by the eleventh census in Illinois are located upon rivers, and their business blocks are built upon alluvial lowlands. Fifteen of the eighteen recorded cities and towns in Indiana were founded upon alluvial plains, though several have since extended partly upon adjacent uplands. The nucleus of every city and town recorded in Iowa was fixed upon a riparian plain, and more than half the urban population of the state today is confined to such plains. In Missouri all the leading cities are partly or wholly riparian. In Ohio, only a half dozen of the more prominent centers of population stand upon uplands, though the larger cities originating on the alluvial lands, have commonly encroached upon the adjacent hills. Two thirds of the cities and towns of Pennsylvania are built largely upon lowlands by the river sides. The eastern cities marking the "fall line" from New York to Richmond are essentially riparian, despite the dearth of alluvial deposits along the line of recent earth movement. If the 355 cities recorded by the eleventh census in the United States between New England and the one-hundredth meridian are grouped according to their situation with respect to waterways, 204, with an aggregate population of 5,593,340, are found to be riparian. There are fifty-nine seaboard and lakeside cities, with a population of 880,043; and twenty-eight unclassified cities aggregating 675,676 in population. Excluding the seaboard and unclassified cities, there remains 48 centers with an aggregate population of 6,033,806, of which eighty-nine per cent is riparian; or, including the various classes, there is a

total urban population of 13,989,529, of which forty per cent is riparian. The concentration of population on the alluvial lands is even more notable among towns and villages than in the larger cities, which have commonly outgrown the valleys and spread over the adjacent uplands. The smooth plains are favorite sites for homesteads and hamlets, for villages and country towns; the most practicable railway routes traverse them; river navigation and industries that depend upon water power attract capital and labor toward them; the most fertile soils are found upon them; and so the banks of the waterways bristle with lesser as well as with greater aggregations of populations. Summarizing the values published by the census bureau and the well-known facts of like import with respect to smaller towns and individual residences, it seems safe to estimate that fully twenty-five or thirty per cent of the population of the United States is crowded upon the fourteen per cent of alluvial lowland. If this estimate is just, then the density of lowland population is about twice as great as that of upland population. In view of certain conditions to which alluvial lands are subject, it would be surprising even to find the population uniformly distributed over lowlands and uplands; it is doubly surprising to find men massed on the lowlands.

The river makes its own bed. Common observation shows that streams of high declivity and rapid flow attack their banks and bottoms, now here, now there, and thus progressively corrode their channels; that streams of low declivity and sluggish flow deposit sand and mud along their banks or on their bottoms, now here, now there, and thus progressively fill their channels with silt; and that streams of medium activity and moderate flow sometimes corrode their sides and bottoms, and again deposit comminuted matter

thereon, thus modifying their channels through a combination of processes. Moreover, it is a matter of common observation that such changes in channels are most rapidly affected during high-water stages, so that the aspect of a trout brook or a mill stream, with its banks of gravel, its glistening cascades, and darkening pools, its grassy banks and flower-fringed meadows, may be completely changed by a single freshet.

These common observations have been extended and systemized by students of the earth and its features; and it has become a fundamental tenet in geologic doctrine, that not only the channel but the valley in which it lies, is fashioned by the stream. There was a time, indeed, when pioneer geologists, misled by the magnitude of the work and the minitute of the agent, ascribed the origin of the valleys to rock-fissuring produced by profound earth movement; but since the days of Lyell the competence of streams to excavate the broadest valleys and the deepest and the most notable canyons has been recognized. The chasm in which the Hudson breaks through the highlands—albeit possibly located by a line of earth fracture—was excavated by the same river that now sluggishly washes the lofty cliffs; the gorge of the Mississippi from St. Paul to Dubuque is the product of corrosion unaided by rock-fracture; the Grand Canyon of the Colorado, foremost among the wonders of a wonderful mountain land, was carved by the sand-reddened river despite the obstructions thrown in its course by earth movement. This appalling chasm is commonly regarded as the most impressive illustration of the efficiency of rivers in trenching the rocky earth crust, yet attentive reading of the geologic record shows that even lesser rivers have wrought even greater results. Thus, during a long-past

age the Susquehanna and the Potomac not only carved canyons twice as deep, though perhaps never so steep of wall, as that of Colorado, but continued their work until the cliffs, spurs, ridges, plateaus, divides, and indeed nearly all of the vast rock mass rising above river level, were borne bit by bit into the Atlantic to build a new land, part of which lies between the "fall line" and the coast. The mountain peaks are shaped by the storm, the mountain gorges are carved by storm waters; the rugged hills and crags are rugged, not because of earth movements, but because of the activity of running water stimulated by steepness of slope; and the broader valleys are more slowly fashioned by the streams winding through their bottoms.

There is an important result of river work whose origin may be recognized through observation or deduced from geologic principles with equal facility; namely, the alluvial plain by which the channel is commonly flanked. The overflowing Nile spreads a veneer of sediment over its delta, and the Egyptian fields are annually fertilized thereby. Before the advent of man the floods of the Mississippi in like manner distributed sediment over the broad delta plain stretching from the mouth of the Ohio to the Gulf; and there are today intelligent planters in the levee-protected parishes of Louisiana who hold that the interests of the delta country would be best promoted by allowing the great river and its tributaries to discharge their waters and to spread their sediment freely over the adjacent lowlands. Lesser rivers in like manner overflow their riparian plains during freshets, dropping sand and silt in depressions and on gentle slopes; and during the great flood which comes once in a decade or once in a century, the entire plain is flooded from bluff to bluff, and the receding waters leave great sheets of river mud, together with

some fresh-cut channels and more banks and bars of silt. It is true that streams of exceptionally great declivity, such as mountain torrents, corrode their channels so rapidly that each freshet falls short of the last; but these are commonly without alluvial plains, and so form a class by themselves. It is patent to every observant resident on rivers and smaller streams conditioned in their usual way, that the freshet waters encroach upon alluvial plains, now here, now there, sometimes over their entire extent, and that, while part of the material is carried far away, part is transported only a few rods, and some that has been brought from a distance is deposited. It is evident, too, to the resident who continues his observations for a decade or a generation, that the degradation, shifting, and deposition of material is commonly such as to preserve the general form of the plain, and to maintain its general relation to the low-water channel on the one hand and to the bounding bluffs on the other.

The flood sediments of the Nile and Mississippi, and the analagous deposits of other rivers, are sands, silts, muds, perhaps gravels, assorted and distributed by currents and eddies in a manner depending upon the configuration of the overflowed plains. Commonly these same materials are identical in character with those of which the entire plain is built, and analogous to them in assortment and distribution. The fisherman by the river side and the husbandman in the riparian field, as well as the systematic student, recognize the substantial identity of the older and newer alluvial deposits, and ascribe both to the agency of the river. The *fellah* on the Nile, the planter on the lower Mississippi, and the trucker on the mill stream perceive that the annual deposits assume the form of sheets of stratified sediment, here coarse, there fine, now thick, now thin, some-

times interrupted, and that successive sheets may be separated by layers of vegetal matter. He commonly perceives, too, that these structural conditions of the surface are repeated in all directions in the mass of material that constitutes the alluvial plain.

All observant dwellers on alluvial lands are aware that the immediate river banks are higher than the more remote portions of the plain. During freshets the water is charged with detritus, and in the swift current of the main channel this detritus, being kept afloat by the whirls and eddies of the raging waters, is transported freely; but as the flood rises, and as the waters escape from the channel over the plain, the current is checked by the shoaling of the water and by the brakes of the bottoms, and so the contained detritus is in part deposited. Now this deposition takes place most rapidly over the lands in the immediate vicinity of the main channel, and in consequence the immediate banks, being most rapidly built up, soon come to be the highest lands in the entire plain. The land may even incline from the river banks to the bases of the distant bluffs. Thus are built, low, broad, natural levees like those of the intricate network of tributaries and distributaries in the Mississippi delta; and thus the stream channels are rendered so unstable that, as time passes, they shift from side to side of the alluvial zone.

The secular shifting of great river channels is recorded in the conformation of the plains. The abandoned channels of the upper Mississippi, for example, are plainly marked by "sloughs," or minor channels, through which part of the current passes; by meandering moats clogged with alluvial sands at one end or both ends; by crescentic lakes completely dis severed from the main and minor channels; and by irregular depressions and morasses scattered

here and there over the plain. That these are the tracts left by the wandering river, is shown by the observations of the river pilot as well as by the inferences of the geologist. When the channel is first diverted, during some great flood, a part of the water flows for a time through the old channel; but the new was selected because it offered a lower level or a shorter course, and it therefore gains on the old until the greater volume of water flows through it. The new passage is rapidly widened by the swift current, while in the old the current lags and the indolent waters drop their sand and silt; so the old channel becomes a slough. Then, during some freshet, the shifting currents build a bar across an extremity of the old channel, and it is finally abandoned save during the highest floods. As time goes on, the other extremity is dammed, and the slough becomes a moat. Next, the ever-wandering river shifts far upon its plain, and may leave the moat miles away from its main channel, to be gradually transformed into a lake of clear water, perhaps fed by two or three streamlets and a dozen springs from the adjacent bluffs, and drained into the main river, or into one of its numberless sloughs, through a deep-cut runnel in the alluvial sands and silts. Finally the lake is filled with the sediment delivered by its streamlets and brought over its banks during freshets, and only an indefinite impression and a meandering stream may remain to tell of its former existence. Thus each cycle of shifting is completed.

One of the earliest generalizations in geologic doctrine grew out of observations on the manner in which rivers build alluvial plains. As such plains lie within reach of the river and suffer overflow by freshets, or at least by great floods, geologists have applied to the alluvial plain the name "flood plain." Nature has thus inscribed in the

valley of each river, and in that of every smaller stream that is conditioned in the usual way, a conspicuous and ineffaceable flood mark. This flood mark is the fertile bottom land of which the pioneer dreamed, the alluvial land upon which the early settlement was founded and on which the modern city is located, the flat lowland over which the engineer builds railroads, the zone upon which population is massed.

The flood plains of scores of rivers are annually overflowed. The floods of the Nile are seldom disastrous, because the customs and industries of the *fellahin* are adjusted to the conditions growing out of the remarkably uniform cycle through which that river annually passes. The great rivers of the Orient are more erratic, and once or twice, or even five times, in each decade the capricious Ganges, the powerful Brahmapootra — “terrible son of the Brahma” — the muddy Yang-tse-Kiang, and the loess-tinted Hoang Ho, burst their barriers, devastating the lowlands and destroying human lives by scores, or even by thousands. The annual cycle of the Mississippi is far less uniform than that of the Nile, the floods vary widely in date and in height, and prevision is handicapped by the levees, both natural and artificial, which protect the lowlands — until the *crevasse* opens. Yet the customs and industries of the delta country are so well adjusted to the conditions growing out of the variable regimen of the river that the losses from overflow involve property rather than life. The planters, with their families and dependents, resort to upland habitations, take refuge on the higher levees and “tow heads,” or fly to the “gin houses,” whose strong supports of framed timbers resist the force of the flood. And the watchful planter, who has learned the strength and weakness of the mighty river, controls it by a sandbag here,

a barrow of earth there, a handful of knot grass yonder; for if the feeble but timely check be not applied, the waters quickly gain such strength as to defy the skill of the engineers and the wealth of states, as at the Bonnet Carré, the Nita, and other *crevasses*.

Every day experience shows that floods are not confined to the greater rivers. They affect as well the smaller ones and their tributaries, down to mill streams and even to storm runnels; and the smaller streams are so many that their aggregate effect of floods is large. Once or oftener during each decade a cry of distress comes from Cincinnati, for the basements of business houses built upon the flood plain are inundated and the residents of the city front are driven from their homes by the prodigious floods of the Ohio; once or twice in each decade East St. Louis and the part of St. Louis standing on the Mississippi alluvium are flooded; from three to five times in each decade the trans-Mississippi traffic at Dubuque is stopped because the flood waters submerge the railway tracks and extinguish the fires of the locomotive. And no year passes without records of disaster in dozens of towns and villages built on the flood plains of smaller streams. And the flood not only works destruction directly; it sows the germs of malarial and enteric disorders by which human life is shortened.

The experience of a decade shows that occasionally exceptional floods inundate a part of the flood plain which the usual vernal freshet barely reaches. On May 27, 1881, passengers on the first train south from Council Bluffs after a memorable freshet in the Missouri River, viewed an impressive but pitiable spectacle. The extensive bottom land was plastered with mud and sand; sites of farm houses were marked by *debris* and by ruined chimneys; staunch barns were undermined, tilted, and rent with unequal set-

ting, their doors and lower planking were torn away, and banks and bars of rotting grain marked the direction of the flood; the great corn-cribs, hundreds of feet in length, were represented only by heaps of half-decayed and sprouting corn; the fences were reduced, here to scattered timber, there to tangled hoops of barbed wire clinging to the stronger posts and clasping the carcasses of cows, horses, and swine; the railway track of a month before was scattered to right and left in hundred-yard links of rails and ties, in bent and twisted rails still grasped by a tie or two, or in scattered ties and broken fish-plates — in short, the fair land of a month before was replaced by a picture of utter desolation, and the air was poisoned by reeking mud, rotting grain, and decaying flesh. This is but one of the many reminders that man may not encroach upon the domain of a river with impunity.

The recorded experience of a century shows that floods unprecedented in memory or in written history sometimes come. Throughout May, 1889, the rainfall in the drainage basin of the Potomac River was exceptionally heavy and continuous, and the ground became saturated to an exceptional degree; and during the closing days of the month heavy showers or persistent rains chanced to fall in the basins of the main stream and its tributaries in such order that the resulting freshets culminated simultaneously. The consequence was an unprecedented flood. The water rose from six to eight feet above the level reached by the highest flood previously known; the canal and railway skirting the river were washed out at many points, so that the traffic was stopped for many days on the railways, and the canal was so nearly destroyed that it has not yet been restored. Lock-houses supposed to be far beyond the reach of the highest freshets, and locks supposed to be indestructible, were

swept away. Over the site of "the log dam" — a structure at Great Falls designed to protect the canal from great freshets — standing above all previous flood marks and above the flood plain of the river as well, the water rushed in a seething torrent seven or eight feet deep, sweeping away the woodwork and most of the masonry of the structure. The broad slack-water estuary at Washington was transformed into a rushing tide which the most powerful steam tugs were unable to stem, and which carried schooners into the broader estuary below in spite of the aid of tugs and anchors; and the water rose in the city until boats plied on Pennsylvania Avenue between the Capitol and the Treasury, and until cellars and basements were flooded and stores of goods were destroyed in the very heart of the capital. Measurements showed that the discharge was at the rate of more than 600,000 cubic feet per second — a discharge at least one and one-third times that of the greatest freshet previously recorded, nearly forty times that of the average for the memorably wet season of 1889 and nearly 600 times that of the minimum low water in the same river. Fully to appreciate this flood, it should be remembered that while the drainage basin of the upper Potomac is less than one per cent of that of the Mississippi, the discharge during this flood closely approached the mean annual outpour of the great river. The builder of a bridge is not satisfied to make his bridge strong enough to bear the expected load, but provides for the unexpected by applying "a factor of safety," of three, or five, or even ten times the anticipated strain; and unprecedented floods like that of the Potomac in 1889 remind builders on the flood plains of rivers that their structures too require a factor of safety.

The lessons of a millennium of observation, those of scientific principle, and those of current experience, are all

the same; but they are either carelessly conned or recklessly ignored by short-sighted men. The spider weaves her web across the well-trodden pathway, to be rent and destroyed by the next passer; the ant, despite its high insect intelligence, persistently burrows in the roadway, unchecked by passing wheels, until its little life is crushed out; the field bunting busies herself in building a nest in the stubble, regardless of the approaching turns of the plow, which must shortly wreck the tiny domicile; the squirrel hides his hoard of nuts a rod from the brink of an advancing railway cut, where it must be undermined on the morrow. Better things might be expected of reasoning man; yet, with equal faith in the fixity of the earth and with equal blindness to the inevitable, he builds his house upon the river sands below nature's unmistakable flood mark. The contemporaries of Daniel Boone and Davy Crockett located their cabins on the flood plains a yard below lodged driftwood, and their descendants still defend the preëmption despite the annual inundation. Along the Ohio and in the lower Mississippi region, scores of pioneers make their homes on the very spots on which their flood-borne flatboats grounded, and were naively surprised when the waters of the succeeding spring washed their floors. During the past summer a residence on an island in Reelfoot Lake was placed ten feet above low water mark, while the mud of the 1890 flood still coated the neighboring cypress boles eighteen feet above the lake. Verily, the short-sighted dumb creatures may find exalted precedents!

The first requisite for protection against a maleficent agency is just appreciation of its magnitude; the second is acquaintance with its mode of operation. The magnitude of the evils of fire, famine, war, and pestilence has long been appreciated, and their modes of operation have been so

thoroughly studied that means of protection have been devised; but, while the magnitude of the flood was appreciated in the olden days, its operations were not analyzed until men, blinded by the conceit born of successful conquest in other directions, forgot its power and crowded into its proper paths, much in the same way that the devotees of a ghastly cult threw themselves before their Juggernaut.

Yet the ways of the flood are now so well known that its ravages may be easily escaped, if only its potency is appreciated. River floods may be controlled, expensively by storage reservoirs for storm waters and melted snows (which should be utilized also for irrigating lands and as sources of power), partially by forest-planting about head-waters and by deforesting the deltas and lower flood plains, and temporarily by levees and cut-offs. But, under existing social and commercial conditions, these methods, which might indeed be applied locally, will probably not be adopted, either during this century or in the next, over the 150,000 square miles of bottom lands skirting the minor rivers and mill streams in the eastern United States. Still, floods may be successfully opposed or escaped. Railways and wagon roads may and must be laid on the flood plains of rivers; but the embankments, and trestles, and bridges should be raised not only above the latest freshet mark, but well above the great natural flood mark found in the plain itself, and the reciprocal effects of embankments and other structures on future freshets should be cautiously reckoned. Farms may be and ought to be located on fertile bottom lands enriched by annual or decennial overflow; but the farmer should dig deep for his foundations and build his superstructures strong and high. On every flood plain of eastern America he should provide for loss of crop and fences once in three, five, or ten years; and both common

humanity and economic policy urge that dumb beasts should be pastured and fed on the uplands, so that the fertile bottoms may be devoted to their best use, namely, the production of plant crops. Cities and towns ought not to be built on the flood-ridden and miasmatic lowlands; yet as they have been in the past and will be in the future, the townsman, like the farmer, should build high and strong, and hold himself ready to remove his family and to carry his goods to upper stories. And the flood-swept bottom lands of the American rivers afford opportunity for a kind of business curiously neglected in the past, though destined to success at no distant day; namely, insurance against floods.

The great desideratum is general recognition of the facts — which are demonstrated by the observations of thousands and gainsaid by none, though ignored by the multitudes — that rivers bear their own flood marks in the alluvial plains by which they are skirted and that men occupy these plains at their peril.

SYMPTOMATIC DEVELOPMENT OF CANCER ¹¹

So little is apparently known of the external symptoms of internal cancer in its early stages that any contribution of attentive observation would seem useful. The following personal case is fairly paralleled by another which need not be described; and the parallelism would seem to give some weight to the inferences.

During my second expedition to Seriland in the autumn of 1895 my party had occasion to climb Sierra Seri, the culminating range of the region. After leaving the wagon camp the party moved on foot (with two pack animals)

¹¹ Reprint from *Science*, September 13, 1912.

over some ten miles of gently upsloping plain to the foothills, where the real climb began; the pace taken was rather rapid and I was somewhat but not excessively tired on reaching the foothills, where the pack horses were to be sent back. Within a few minutes after starting the climb I observed a condition novel in my experience, *i. e.*, inability to lift the feet (especially the left) more than a few inches above the level at which I stood. There was no pain, scarcely any discomfort — merely the inability to raise the feet without help from the hands. Assuming it a manifestation of exhaustion, I halted the party for a time and ate lunch; but, on resuming, the condition almost immediately returned. Greatly puzzled, I abandoned the climb and started back with the Indian in charge of the pack-horses, finding no difficulty in going down-slope. Within fifteen minutes I was startled by a call from one of the remainder of the party making the climb, "El Gringo es muerto [the American is dead]." Even without explanation I knew this referred to W. D. Johnson, topographer of the expedition; and stimulated by the apparent tragedy I immediately turned to resume the climb to the point of the disaster — but despite the intense excitement, I had not climbed fifty steps before the former inability to lift the feet returned. So I remained in a virtually helpless condition (sending my Indian up to the climbing party with specific inquiries) for perhaps half an hour; when the Indian returned with the gratifying intelligence that "El Gringo" had come to life and had gone on up the mountain — for it appeared he had merely swooned under the stress of the long walk and the early stages of a stiff climb, and, recovering, had gone on with his accustomed persistence. This episode marked the first observed abnormality in locomotory powers which had been above the average.

The next noteworthy manifestation appeared during the

expedition of 1900, when I frequently found myself unable to raise the left foot to the stirrup on mounting — indeed it became necessary generally to modify the attitude in mounting so as to permit giving a hitch upward to the left foot with the hand. Sometimes, too, on dismounting the left leg partially gave way; so that I acquired the habit of swinging out of the saddle in such a manner as to land on both feet. During subsequent months in office work I noticed an abnormal condition, although I failed at the time to associate it with that experienced in the field, i. e., on rising after occupying my chair for a considerable time, either a sharp pain or a sensation of weakness was experienced in the left groin. This condition continued until the habit was acquired of rising with care and putting the weight at first wholly on the right foot.

In 1902 I noticed that the foot-fall sounds of my two feet as I walked the pavement were unlike; and I made considerable vain effort, sometimes with the help of friends, to find the reason for the asymmetry in movement indicated by the diversity in sound. This abnormality was not then associated with the abnormal conditions observed in field and office; but when within a year I noticed that the sole of the left shoe wore out twice as rapidly as that of the right I began to associate the several conditions, though without forming any idea as to cause.

In 1906 I suffered an epididymitis on the left; and in casting about for the cause of this attack . . . I gladly welcomed the occasion to have an expert blood examination made by a practitioner recently from an expert school of note in London. The examination . . . gained my confidence by detecting evidences of a typhoid fever through which I had passed some years previously; but it left the epididymitis totally unexplained.

About this time I made a trip through the Sierra Nevada region, largely in company with Gifford Pinchot, then Chief Forester, and J. A. Holmes, now Director of Mines; and in the course of the trip was much embarrassed by inability to climb or to ascend slopes of more than moderate degree — the trouble lying in the same inability to lift the feet first observed in Seriland.

In the autumn of 1909 while in field work in Washington state I noticed uncertainty in coördination of the control and movement of the left foot, especially in passing over slippery rocks or logs; and on one occasion suffered an accident of some severity due to a needless slip of the left foot. About this time also I noticed a slight bladder difficulty which continued increasingly for over a year — when . . . in April, 1911, I underwent an operation which revealed a cancerous condition in which the carcinomatous tissue was of an exceptionally hard type, and too extended for complete extirpation. Recovery was tedious and complicated, and within a few weeks after leaving the hospital an epididymitis on the right developed — this time with little doubt in my mind as to the cause. The symptom of weakness and pain in the left groin also recurred with increased intensity, and a hitching gait was developed. The bladder never became completely normal; and in January, 1912, the lower intestine evidently became affected, producing assimilative difficulties of growing gravity.

In April, 1912 — a year after the operation — a condition gradually developed in the tendons of the left knee similar to that observed in the groin — the twinge of pain on sudden movement, inability to exercise full control, etc. The general burden on the system attending the abnormal development was noticed (without realization of the cause) about 1904, and unceasingly thereafter.

Any significance this record may have lies merely in bringing out the association between a series of obscure and puzzling symptoms developed in the course of several years, which finally seem to have found explanation in the cancerous growth revealed well toward the end of the series.

W J McGEE

BIBLIOGRAPHY

- SOIL EROSION. U. S. Dept. of Agr., Bureau of Soils, Bull. No. 71, 1911, pp. 1-60, pls. i-xxxiii.
- THE LESSONS OF GALVESTON. Nat. Geog. Mag., Vol. xi, 1900, pp. 377-383.
- WELLS AND SUB-SOIL WATER. U. S. Dept. Agr., Bureau of Soils, Bull. No. 92.
- PRINCIPLES OF WATER-POWER DEVELOPMENT. Science U. S., Vol. 34, sec. 15, 1911, pp. 813-825.
- PROSPECTIVE POPULATION OF U. S. Science U. S., Vol. 34, Oct. 6, 1911, pp. 428-435.
- HONORS TO JAMES HALL AT BUFFALO. Science, U. S., Vol. 4, 1896, pp. 697-706.
- GEOGRAPHIC HISTORY OF PIEDMONT PLATEAU. Nat. Geog. Mag., Vol. vii, 1896, pp. 261-265.
- ON THE AGE OF THE EARTH. Science, Vol. 21, 1893, pp. 300-310.
- A GEOLOGICAL PALIMPSEST. The Literary Northwest, Vol. ii, 1893, pp. 274-276.
- THE MISSISSIPPI BED-LANDS. The Forester, Vol. 3, 1897, page 7.
- SHEETBED EROSION OF SONORA DISTRICT, MEXICO. Bull. Geol. Soc. Am., Vol. 8, 1897, pp. 87-112.
- GEOLOGIC MAP OF U. S. Johnson's Universal Cyclopedia, Vol. 3, 1893, pp. 728-731.
- RECONNAISSANCE MAP OF U. S. U. S. Geol. Survey, 14 Ann., Sept., pl. II, 1803.

- RECONNAISSANCE MAP OF U. S. Am. Geol., Vol. 16, 1895, pp. 113, 114.
- GEOLOGIC MAP OF U. S. AND CANADA. Longman's New School Atlas, New York, 1892.
- CLASSIFICATION PLEISTOCENE DEPOSITS. Int. Cong. Geol. Rendur, 5th Sess., 1893, pp. 198-207.
- RELATIVE POSITIONS OF FOREST BED AND ASSOCIATED DRIFT FORMATIONS IN NORTHEASTERN IOWA. Am. Jour. Sci., 3rd ser., Vol. 15, 1878, pp. 339-341.
- ARTIFICIAL MOUNDS IN NORTHEASTERN IOWA. Am. Jour. Sci., 3rd ser., Vol. 16, 1878, pp. 272-278.
- COMPLETE SERIES OF SUPERFICIAL FORMATIONS IN NORTHEASTERN IOWA. Am. Assoc., Adv. Sci., Proc., Vol. 27, 1879, pp. 198-231.
- SURFACE GEOL. OF A PART OF MISS. VALLEY. Geol. Mag., U. S., Vol. 6, 1879, pp. 353-361; 412-420.
- SUPERPOSITION OF GLACIAL DRIFT UPON RESIDUARY CLAYS. Am. Jour. Sci., 3rd ser., vol. 18, 1879, pp. 301-303.
- SOME IOWA KAMES AND AASAR. Iowa Acad. Sci., Proc., Vol. 1, pt. 1, 1875-1880, p. 15.
- THE "LATERITE" OF THE INDIAN PENINSULA. Geol. Mag., U. S., Vol. 7, 1880, pp. 310-313.
- ADDITIONAL OSERVATIONS ON IOWA KAMES. Iowa Acad. of Sci., Proc., Vol. 1, pt. 1, 1875-1880, p. 25.
- MAXIMUM SYNCHRONOUS GLACIATION. Am. Assoc. Avd. Sci., Proc., Vol. 29, 1881, pp. 447-509.
- SOME ELEMENTS IN ORTHOGRAPHIC DISPLACEMENT. Am. Jour. Sci., 3rd ser., Vol. 21, 1881, pp. 276-278.
- THE GEOLOGY OF IOWA SOILS. Iowa State Horticultural Soc., Trans., vol. 15, 1881, pp. 191-195.
- SHALE AND DAVIS' "GLACIERS." Sci., vol. 2, 1881, pp. 581-584; 624-630.

- LOCAL SUBSIDENCE PRODUCED BY ICE-SHEET. *Am. Jour. Sci.*, 3d ser., vol. 22, 1881, pp. 368-369.
- PROPOSED MODIFICATIONS IN THE GEOLOGIC NOMENCLATURE. *Int. Cong. Geology, Compte Rendu*, 2d ser., 1882, pp. 620-622.
- EVAPORATION AND ECCENTRICITY, CO-FACTORS IN GLACIAL PERIODS. *Am. Jour. Sci.*, 3d ser., vol. 23, 1882, pp. 61, 62.
- THE RELATION OF GEOLOGY AND AGRICULTURE. *Iowa State Horticultural Soc., Trans.*, vol. 16, 1882, pp. 222-240.
- LOESS AND ASSOCIATED DEPOSITS OF DES MOINES. *Am. Jour. Sci.*, 3d ser., 1882, pp. 202-223.
- REPORT ON GEOLOGY AND SOILS. *Ia. State Horticultural Soc., Trans.*, vol. 17, 1883, pp. 270-280.
- ORIGIN OF NORMAL FAULTS. *Am. Jour. Sci.*, 3d ser., vol. 26, 1883, pp. 294-298.
- PRES. STATUS OF ECCENTRICITY THEORY OF GLACIAL CLIMATE. *Am. Jour. Sci.*, 3d ser., vol. 26, 1883, pp. 113-120.
- GLACIAL CANYONS. *Am. Assoc. Adv. Sci., Proc.*, vol. 32, 1883, p. 238.
- GEOLOGICAL DISTRIBUTION OF FORESTS. *Pop. Sci. Mo.*, vol. 24, 1883, p. 115.
- CAUSE OF GLACIAL PERIOD. *Am. Jour. Sci.*, 3d ser., vol. 26, 1883, p. 244.
- DRAINAGE SYSTEM AND DISTRIBUTION OF LOESS OF EASTERN IOWA. *Wash. Phil. Soc., Bull.*, vol. 6, 1883, pp. 93-97.
- Iowa State Horticult. Soc., Trans.*, vol. 18, 1883, pp. 1-14.
- SUBTERRANEAN FOREST IN DISTRICT OF COLUMBIA. *Sci.*, vol. 2, 1883, p. 724.
- WHAT IS A GLACIER? *Phil. Soc., Bull.*, vol. 7, 1884, p. 38.
- MERIDIONAL DEFLECTION OF ICE-STREAMS. *Am. Jour. Sci.*, 3d ser., vol. 29, 1885, pp. 386-392.
- THE TERRACES OF THE POTOMAC VALLEY. *Phil. Soc. Wash., Bull.*, vol. 8, 1885, p. 24.

SOME FEATURES OF THE RECENT EARTHQUAKE. *Sci.*, vol. 8, 1886, pp. 271-275.

GEOGRAPHY AND TOPOGRAPHY OF THE HEAD OF CHESAPEAKE BAY. (Read before Am. Assoc. Adv. Sci., 1886.) *Am. Jour. Sci.*, 3d ser., vol. 32, 1886, p. 323. Abstract.

OVIROS CAVIFRONS FROM THE LOESS OF IOWA. *Am. Jour. Sci.*, ser. 3, vol. 34, 1887, pp. 217-220.

COLUMBIA FORMATION. *Am. Assoc. Adv. Sci., Proc.*, vol. 36, 1887, pp. 221-222.

THE FIELD OF GEOLOGY AND ITS PROMISE FOR THE FUTURE. *Minn. Acad. Nat. Sci., Bull.* vol. 3, 1887-1889, pp. 191-206.

TUSCALOOSA FORMATION. *U. S. Geol. Survey, Bull.* No. 43, 1887, pp. 247-255.

THE GEOLOGY OF THE HEAD OF CHESAPEAKE BAY. *U. S. Geol. Survey, 7th Ann. Rept.*, 1885-1886, pp. 537-646.

THREE FORMATIONS OF MIDDLE ATLANTIC SLOPE. *Am. Jour. Sci.*, 3d ser., vol. 35, 1888, pp. 120-143; 328-330; 448-466.

CLASSIFICATION OF GEOGRAPHIC FORMS BY GENESIS. *Nat. Geog. Mag.*, vol. 1, 1888, pp. 27-36.

NOTES ON GEOLOGY MACON COUNTY, MO. *St. Louis Acad. of Sci., Trans.*, vol. 5, 1888, pp. 305-336.

SOME DEFINITIONS IN DYNAMICAL GEOLOGY. *Geol. Mag., Lond.*, vol. 5, 1888, pp. 489-495.

PALEOLITHIC MAN IN AMERICA. *Pop. Sci. Mo.*, vol. 34, 1888, pp. 20-36.

SOME PECULIARITIES OF THE SUPERFICIAL DEPOSITS OF NORTHEAST IOWA. *Am. Geol.*, vol. 2, 1888, pp. 137, 138.

AN AMERICAN GEOLOGIC SOCIETY. *Science*, vol. 3, 188, p. 1.

GEOLOGIC ANTECEDENTS OF MAN IN THE POTOMAC VALLEY. *Am. Anthropologist*, vol. 2, 1889, pp. 227-234.

THE WORLD'S SUPPLY OF FUEL. *The Forum*, vol. 7, 1889, pp. 553-566.

THE SOUTHERN EXTENSION OF THE APPOMATTOX FORMATION. *Am. Jour. Sci.*, 3d ser., vol. 40, 1890, pp. 15-41.

- TOPOGRAPHIC TYPES OF NORTHEASTERN IOWA. Am. Assoc. Adv. Sci., Proc., vol. 38, 1890, pp. 248-249.
- ENCROACHMENTS OF THE SEA. The Forum, vol. 9, 1890, pp. 437-449.
- REMARKS ON PRESSURE OF ROCK GAS, ESPECIALLY IN INDIANA. Bull. Geol. Soc. Am., vol. 1, 1890, pp. 96, 97.
- REMARKS ON THE FORMATIONS COMPRISED UNDER NAME OF "ORANGE SANE" AND RELATION OF CERTAIN LOAMS AND GRAVELS IN VICINITY OF VICKSBURG. Bull. Geol. Soc. Am., vol. 1, 1890, pp. 474, 475.
- PECULIARITIES OF DRAINAGE IN SOUTHEASTERN UNITED STATES. Bull. Geol. Soc. Am., vol. 1, 1890, pp. 448, 449.
- RELATIONS OF THE PLEISTOCENE DEPOSITS OF BELVIDERE ON THE DELAWARE. Bull. Geol. Soc. Am., vol. 1, 1890, p. 480.
- GEOLOGY FOR 1887 AND 1888. Smithsonian Inst. Rept. 1888, pt. 1, 1890, pp. 217-260.
- IOWA. MACFARLANE'S GEOL. RWY. GUIDE. 2d edition, 1890, pp. 232-245.
- THE COLUMBIAN FORMATION. Am. Assoc. Adv. Sci., Proc., vol. 36, 1888, pp. 221, 222.
- THE COLUMBIA FORMATION IN THE MISS. EMBAYMENT. Bull. Geol. Soc. Am., vol. 2, 1891, pp. 2-6.
- POTOMAC DIVISION GEOLOGICAL SURVEY. U. S. Geol. Survey, 10th Ann. Rept., 1890, pp. 148-158.
- FLOOD PLAINS OF RIVERS. The Forum, vol. II, 1891, pp. 221, 234.
- NEOCENE AND PLEISTOCENE CONTINENT MOVEMENTS. Am. Assoc. Adv. Sci., Proc., vol. 40, 1891, pp. 253, 254.
- THE SOUTHERN OIL FIELDS. Am. Assoc. Adv. Sci., Proc., vol. 40, 1891, p. 417.
- THE PLEISTOCENE HISTORY OF NORTHEASTERN IOWA. U. S. Geol. Survey, 11th Ann. Rept., pt. 1, 1891, pp. 499-557.
- ROCK GAS AND RELATED BITUMENS. U. S. Geol. Survey, 11th Ann. Rept., pt. 1, 1891, pp. 589-616.

- REPORTS OF THE DELEGATES TO THE CONGRÉS GÉOLOGIQUE INTERNATIONAL. *Am. Anthropologist*, vol. 5, 1892, pp. 45-48.
- THE GULF OF MEXICO AS A MEASURE OF ISOSTASY. *Am. Jour. Sci.*, 3d ser., vol. xliv, 1892, pp. 177-192.
- THE REAL WORK OF THE U. S. GEOL. SURVEY. *Am. Geol.*, vol. x, 1892, pp. 337-379.
- THE FIELD OF GEOLOGY AND THE PROMISE FOR THE FUTURE. *Minn. Acad. Sci., Bull.*, vol. III, 1862, pp. 191-206.
- A FOSSIL EARTHQUAKE. *Bull. Geol. Soc. Am.*, vol. 4, 1893, pp. 414-414.
- W J MCGEE AND G. H. WILLIAMS GEOLOGY OF WASHINGTON AND VICINITY. *Int. Congrès Géol., Compte Rendu*, 5th sess., 1893, pp. 219-251.
- THE LAFAYETTE FORMATION. *U. S. Geol. Survey*, 12th Ann. Rept., pt. 1, 1892, pp. 353-521.
- GEOLOGIC MAP OF U. S. AND CANADA. Longman's New School Atlas, New York, 1892.
- MAN AND THE GLACIAL PERIOD. *Science*, vol. 26, p. 317; *Am. Anthropologist*, vol. 6, 1892, pp. 85-95.
- GRAPHIC COMPARISON OF POST COLUMBIA AND POST LAFAYETTE EROSION. *Am. Assoc. Adv. Sci., Proc.*, vol. xiii, 1894, p. 179.
- CLASSIFICATION OF PLEISTOCENE DEPOSITS. *Int. Cong. Geol. Compte Rendu*, 5th sess., 1893, pp. 198-207.
- CORRELATION OF CLASTIC ROCKS. *Int. Cong. Geol. Compte rendu*, 5th sess., 1893, pp. 160-166.
- GLACIAL PHENOMENA. Discussion of paper, by C. H. Hitchcock, "Studies of the Corn Valley Glacier." *Bull. Geol. Soc. Am.*, vol. 4, 1893, pp. 5, 6 and 6, 7.
- THE PRAIRIES. ITINERARY FROM KANSAS CITY, MO. TO CHICAGO, ILL. *Int. Cong. Geol. Compte rendu*, 5th sess., 1893, pp. 440-452.

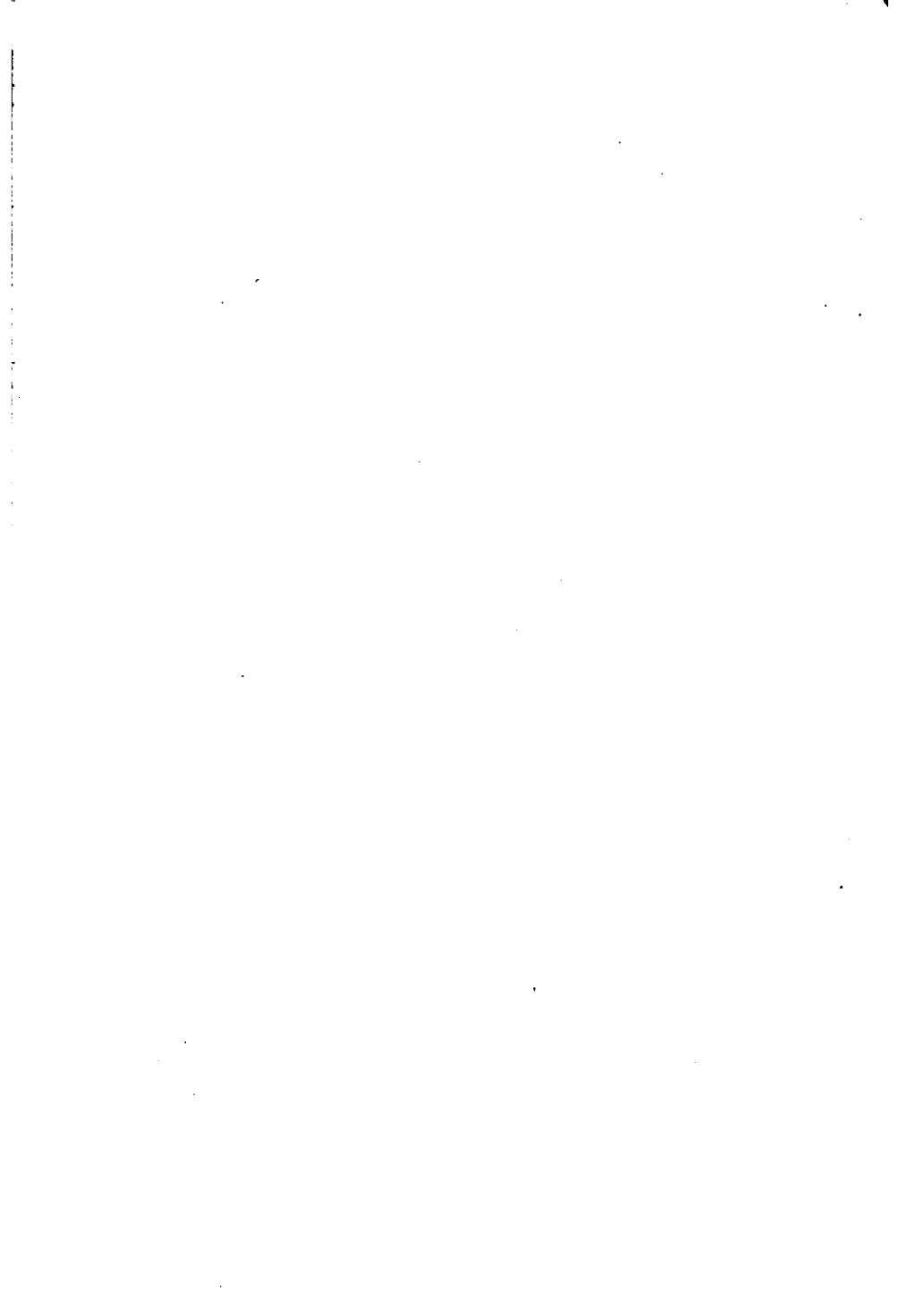
- GLACIAL CANYONS. Jour. Geol., vol. II, 1894, pp. 350-364.
- THE EXTENSION OF UNIFORMITARISM TO DEFORMATION. Bull. Geol. Soc. Am., vol. 6, 1894, pp. 55-70.
- THE POTABLE WATERS OF EASTERN UNITED STATES. U. S. Geol. Survey, 14th Ann. Rept., pt. 2, 1894, pp. 1-17, figs. 4, 5.
- CENOZOIC HISTORY OF EASTERN VIRGINIA AND MARYLAND. Bull. Geol. Soc. Am., vol. 5, 1894, p. 24.
- EXTRA MORAINIC DRIFT OF NEW JERSEY. Bull. Geol. Soc. Am., vol. 5, 1893, pp. 17, 18.
- COLUMBIAN AND LAFAYETTE FORMATIONS. Bull. Geol. Soc., Am., vol. 5, 1894, p. 100.
- TERRESTRIAL SUBMERGENCE SOUTHEAST OF AMERICAN CONTINENT. Bull. Geol. Soc., vol. 5, 1894, pp. 21, 22.
- TOPOGRAPHIC DEVELOPMENT OF SONORA. Science, U. S., vol. 1, 1895, pp. 558, 559.
- CANYONS OF COLORADO. Science, U. S., vol. 2, 1895, pp. 593-597.
- A MINIATURE EXTINCT VOLCANO. Am. Assoc. Adv. Sci., Proc., vol. xiiii, 1895, pp. 225, 226.
- EXPEDITION TO SERILAND. Science, U. S., vol. iii, 1896, pp. 493-505.
- TWO EROSION EPOCHS. Science U. S., vol. iii, 1896, pp. 796-799.
- HATCHER'S WORK IN PATAGONIA. Nat. Geog. Mag., vol. 8, 1897, pp. 319-322.
- GEOGRAPHIC DEVELOPMENT OF DISTRICT OF COLUMBIA. Nat. Geog. Mag., vol. ix, 1898, pp. 317-323.
- PROF. O. C. MARSH. Nat. Geog. Mag., vol. 10, 1879, pp. 181-182.
- THE PRE-LAFAYETTE BASE LEVEL. Abs. Am. Assoc. Adv. Sci. Proc., vol. xlviii, 1897, p. 227, and Sci., U. S., vol. x, 1890, p. 480.

THE GEOLOGY AND ARCHEOLOGY OF CALIFORNIA. Abs. Am. Geol., vol. 23, 1899, pp. 96-99.

THE LESSONS OF GALVESTON. Nat. Geog. Mag., vol. xi, 1900, pp. 337-383.

THE GULF OF CALIFORNIA AS AN EVIDENCE OF MARINE EROSION. Abs., Science, U. S., vol. xl, 1900, p. 129.

OCCURRENCE OF PENSANKEN FORMATION. Abs., Am. Assoc. Adv. Sci., Proc., vol. xlix, 1900, p. 187.



1 port. 88

**THE NEW YORK PUBLIC LIBRARY
REFERENCE DEPARTMENT**

**This book is under no circumstances to be
taken from the Building**

[illegible]